The Bycatch Mitigation Research Box

Students' materials



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Bycatch in global fisheries

Challenges and ways forward

Getting Started

Task 1: Background and aims of the CIBBRiNA project

Why bycatch matters.

Task 2: Profiles and anatomy

Get to know the ETP species and their vulnerabilities.

How Fishing Affects Marine ETP Species

Task 3: Which ETP species are affected by which fishing method?

Connect fishing methods with risks for different species.

Task 4: The challenge

Explain fishing methods, ecosystems, and develop prompts.

Finding and Discussing Solutions

Task 5: Research project

Plan your own study and propose solutions.

Task 6: Evaluating bycatch

Discuss strengths and weaknesses of existing solutions.

Task 7: Final discussion with roles

Debate perspectives of different stakeholders.

Task 1

All about CIBBRiNA

task

Individual work

Have a look at this video about CIBBRiNA and the project website, and then answer the questions about the project

We are exploring the best possible ways to minimise bycatch of Endangered, Threatened, and Protected (ETP) species which will support their conservation and be practical for fishers.

For fishers, bycatch of ETP species is a problem which affects their time, income, and reputations, and can cause them distress – so practical solutions will help to support them.

Minimising the bycatch of ETP species is essential to the flourishing of both marine ecosystems and fishing livelihoods.

Questions about the project

working sheet

Background and aims of the project

What is the CIBBRiNA project and what are its main objectives?

Why is it important to reduce bycatch of Endangered, Threatened, and Protected (ETP) species?

Methods and approaches

Who are the participants in the CIBBRiNA project?

Which role do fishers play in CIBBRiNA?

Questions about the project

working sheet

Challenges and solutions

What are the challenges in implementing measures to reduce bycatch?

Give an example of a successful bycatch reduction measure.

Which long-term perspectives does the CIBBRiNA project have regarding bycatch reduction/prevention?

Task 2

Questions about the project

information

Our selected animal species



Loggerhead turtle
Caretta caretta



Razorbill
Alca torda

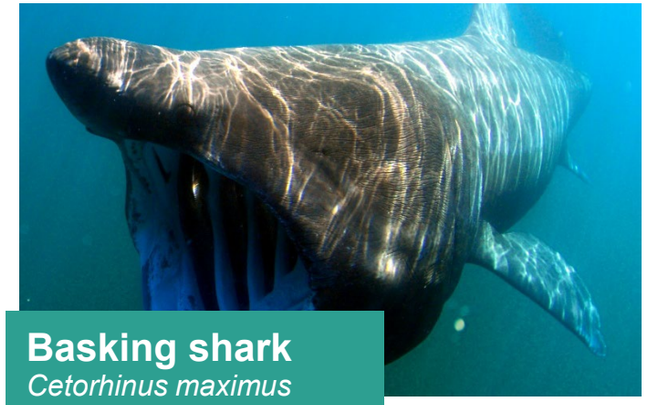


Common dolphin
Delphinus delphis



Common blue skate
Dipturus batis

Source: Cambraia Duarte P.M.N. © ImagDOP



Basking shark
Cetorhinus maximus

Source: Greg Skomal | NOAA Fisheries Service © Wikimedia Commons

Profiles and anatomy

task

Individual work/partner work

A. Conduct online research to fill the profile of your animal species.

B. Use the distribution maps of your animal species to describe where it lives (its distribution). If you find words you do not understand (for example: *continental shelf, slope, offshore, aggregation, colony, migration*), try to find out what they mean. You can search on the internet or use an AI tool to get a simple explanation.

C. Think about which characteristics or behaviours make this species especially vulnerable to bycatch?

How to | Correct internet research

information

1 Finding reliable sources

- **Preferred**: Websites of universities, government institutions or large organisations
- **Avoid**: Blogs, private websites and forums if they have no scientific basis
- **Advice**: Check whether the author is an expert in the field and whether the page contains up-to-date information

2 Compare multiple sources

- Always look for **at least two to three** independent sources to verify information
- Make sure that all sources provide similar facts and results

3 Choose search terms cleverly

- Use specific search terms: Instead of searching for “sea animal", try “marine species"
- Use synonyms and specific technical terms to obtain different results
- Try **"and"**, **"or"** and quotation marks for exact terms ("climate change causes")

4 Distinguishing between facts and opinions

- Pay attention to whether the information **is factual or opinion-based**
- Reputable sources use neutral language and back up statements with sources

5 Copyright and citation

- Do not simply copy information and images! Take notes and cite sources correctly
- Uses **citation aids** (e.g. citation generators) for correct references

6 Recognising fake news and misinformation

- Watch out for sensational headlines and **missing sources**
- Check the publication date to ensure that the information is up-to-date
- **Fact-checking sites** such as "mimikama.at" or "correctiv.org" help to expose false information

C

Loggerhead turtle | Behaviour and biology

information



Bycatch Mitigation and the Loggerhead Sea Turtle (*Caretta caretta*): Understanding Behaviour and Biology to Reduce Accidental Catch

The loggerhead sea turtle is a long-lived marine reptile that faces significant threats such as bycatch in commercial fisheries worldwide. Especially in longline, trawl, and gillnet fisheries, this species is frequently caught accidentally—often with fatal consequences (**ACC**). Reducing bycatch depends on understanding the turtles´ migratory behaviour, diving patterns, and habitat use.

Long-distance migration and coastal nesting:
Loggerhead turtles migrate thousands of kilometres between feeding grounds and nesting beaches. During migration, they pass through regions with intensive fishing activity. Females return to specific beaches to lay eggs, usually every 2–3 years. Coastal fisheries near nesting sites, such as in the Mediterranean or southeastern USA, pose a high risk of accidental capture.

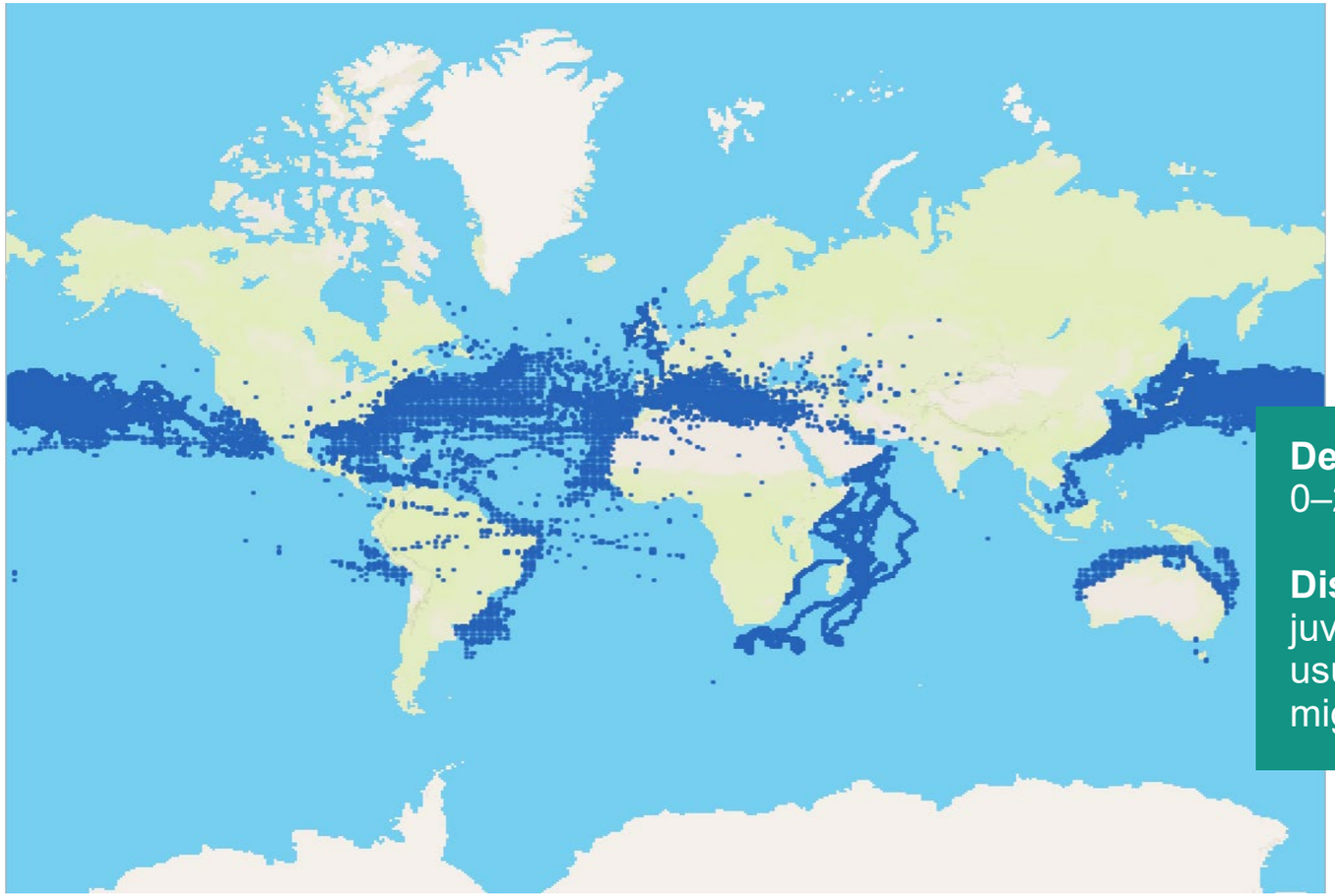
Diving and feeding behaviour:
Loggerheads dive to forage on molluscs, crustaceans, and other benthic prey. They often interact with demersal longlines and bottom trawls when searching for food. They can stay submerged for up to several hours, making them especially vulnerable to gear that does not allow a quick escape or surfacing.

Delayed maturity and low reproduction rates:
Loggerhead turtles take 20–30 years to reach maturity and lay relatively few eggs per clutch. Juvenile and adult survival is critical for population preservation. High bycatch mortality—particularly of females—can quickly destabilise regional populations.

B

Loggerhead turtle | Distribution

information



Depth range:
0–200 m (mostly upper 50 m)

Distance from shore:
juveniles offshore, hundreds of km; adults usually <30 km from coast between migrations

Distribution data supplied by the Ocean Biodiversity Information System (OBIS)
marlin.ac.uk/species/detail/2094

Loggerhead turtle | Profile and anatomy

working sheet

General features

family:

size:

weight:

colour:

life expectancy:



Nutrition

food:

hunting behaviour:

Reproduction

gestation period:

birth:

rearing:

Special features

behaviour:

protection status:

threats:

Distribution and habitat

occurrence:

habitat:

position in the water & diving depth:

distance from shore:

Which characteristics or behaviours make this species especially vulnerable to bycatch?

(e.g. habitat, movement, feeding behaviour, size)

C

Razorbill | Behaviour and biology

information



Bycatch Mitigation and the Razorbill (*Alca torda*): Understanding Behaviour and Biology to Reduce Accidental Catch

The razorbill, a seabird of the North Atlantic, is increasingly affected by bycatch in gillnet and longline fisheries. Although not a fishing target, its diving behaviour and foraging habitats overlap strongly with areas of intense fishing activity, especially in coastal regions. Reducing bycatch requires integrating knowledge of razorbill behaviour, ecology, and seasonal patterns.

Diving behaviour and underwater foraging:
Razorbills are pursuit divers, using their wings to “fly” underwater in search of small fish like sand eels and herring. They can dive to depths of over 100 meters. This brings them into direct contact with static gear such as bottom-set gillnets, which are particularly dangerous because they are nearly invisible underwater for these birds. Entanglement often leads to drowning.

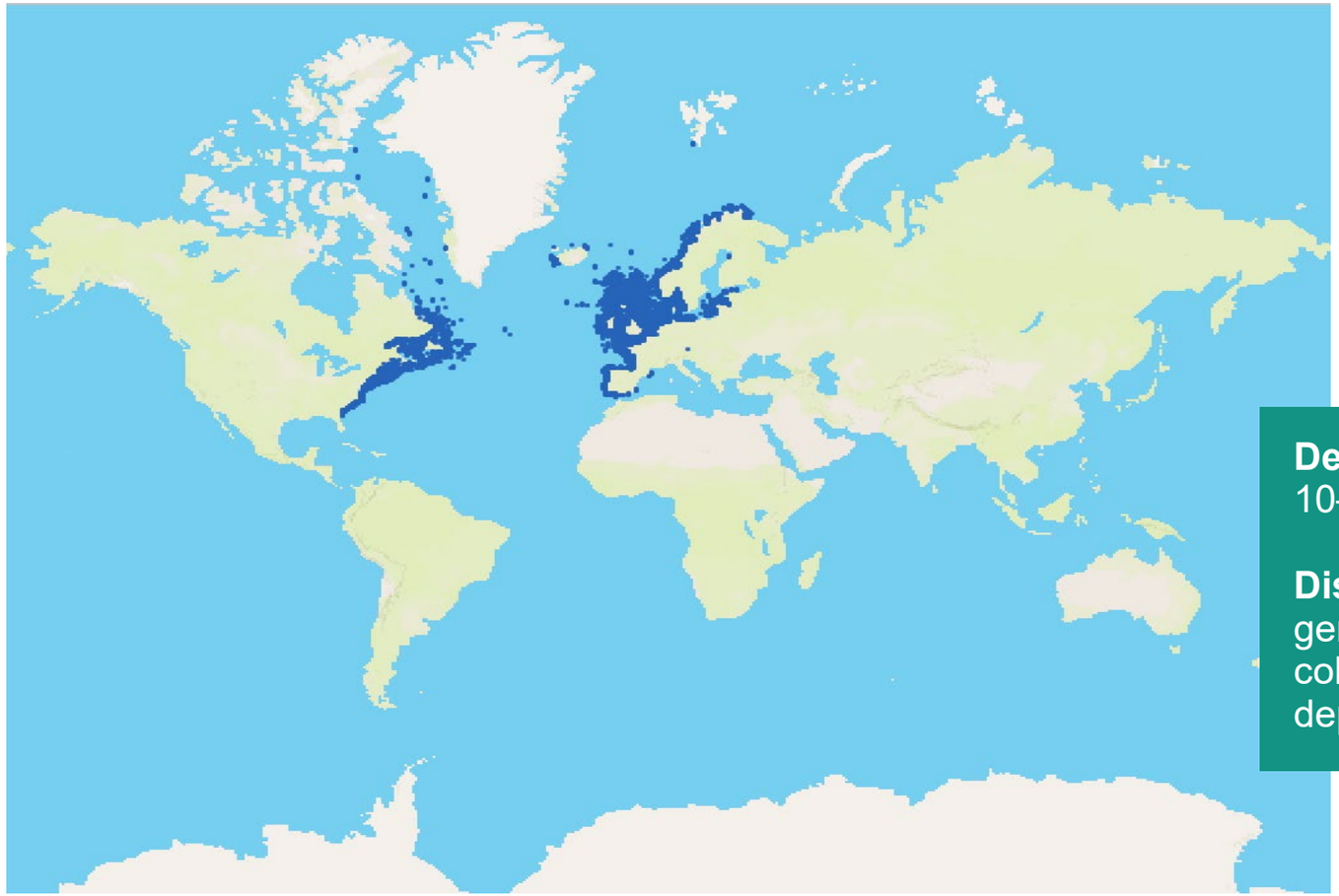
Colonial nesting and coastal concentration:
Razorbills nest in dense colonies on cliffs and rocky islands during spring and early summer. During this period, they forage close to shore, often in areas heavily fished by small-scale coastal fleets using set nets. Their foraging areas are relatively predictable, which creates opportunities for targeted mitigation measures.

Limited breeding range and population sensitivity:
Razorbills typically lay only one egg per year and both parents invest strongly in chick rearing. Adult mortality due to bycatch has a disproportionately large effect on population growth. Because razorbills are long-lived and have low reproductive rates, even small increases in adult mortality can cause long-term declines.

B

Razorbill | Distribution

information



Depth range:
10–120 m (typically 10–40 m)

Distance from shore:
generally within 50 km of coast/breeding colony over continental shelf (<200 m bottom depth)

Distribution data supplied by the Ocean Biodiversity Information System (OBIS)
marlin.ac.uk/species/detail/2205

A

Razorbill | Profile and anatomy

working sheet

General features

family:

size:

weight:

colour:

life expectancy:



Nutrition

food:

hunting behaviour:

Reproduction

gestation period:

birth:

rearing:

Special features

behaviour:

protection status:

threats:

Distribution and habitat

occurrence:

habitat:

position in the water & diving depth:

distance from shore:

Which characteristics or behaviours make this species especially vulnerable to bycatch?

(e.g. habitat, movement, feeding behaviour, size)

C

Common dolphin | Behaviour and biology

information



Bycatch Mitigation and the Common Dolphin (*Delphinus delphis*): Understanding Behaviour and Biology to Reduce Accidental Catch

The common dolphin is one of the most widespread and abundant dolphin species, yet in many regions it faces serious threats such as accidental capture in fishing gear. In particular, pelagic trawl and gillnet fisheries are major sources of dolphin bycatch. Effective mitigation requires a detailed understanding of this species' behaviour, ecology, and interactions with fisheries.

Social and group-based behaviour:
Common dolphins are highly social and often travel in large groups (or schools). This social structure, while beneficial for foraging and communication, increases the risk of mass bycatch events—where multiple individuals are caught at once, particularly in large-scale trawl nets or encircling purse seines.

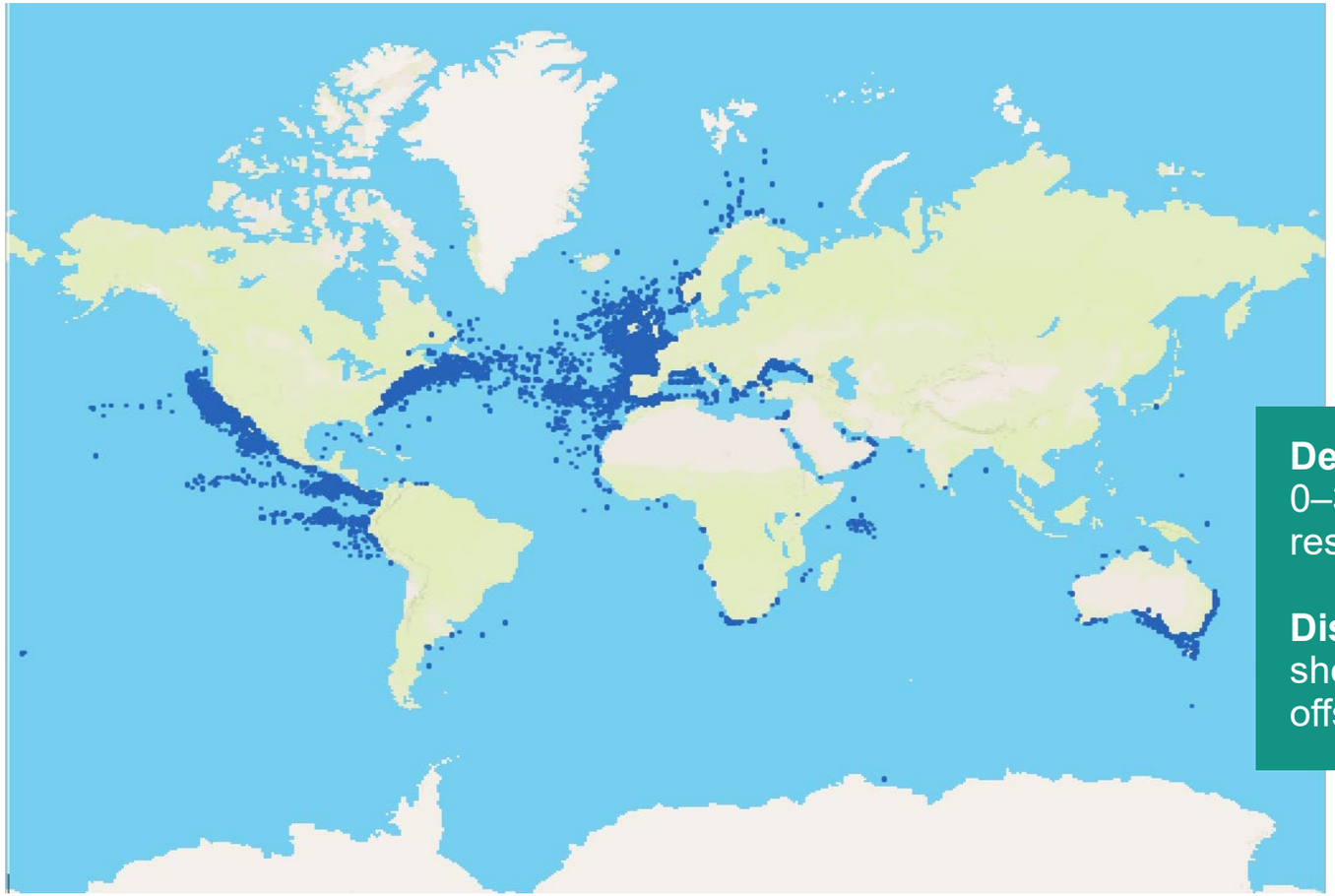
Rapid, active swimmers:
Common dolphins are fast, agile swimmers that can follow fish shoals targeted by fisheries, such as mackerel or herring. This makes them especially vulnerable to being trapped when pursuing the same prey as fishing vessels. They may not always detect or avoid nets in time, especially during nighttime operations.

Wide distribution, seasonal concentrations:
Although they are found in tropical and temperate waters worldwide, certain populations—such as those in the Bay of Biscay or the eastern North Atlantic—gather seasonally in areas with high fishing pressure. These aggregations often coincide with peak activity in pelagic trawl fleets, increasing the risk of bycatch (**Source ACC & SWE**).

B

Common dolphin | Distribution

information



Depth range:
0–300 m (mostly top 10 m when resting/traveling)

Distance from shore:
shelf-edge/open-ocean waters 20–200 km offshore; rarely in shallow bays

Distribution data supplied by the Ocean Biodiversity Information System (OBIS)
marlin.ac.uk/species/detail/2082

A

Common dolphin | Profile and anatomy

working sheet

General features

family:

size:

weight:

colour:

life expectancy:



Nutrition

food:

hunting behaviour:

Reproduction

gestation period:

birth:

rearing:

Special features

behaviour:

protection status:

threats:

Distribution and habitat

occurrence:

habitat:

position in the water & diving depth:

distance from shore:

Which characteristics or behaviours make this species especially vulnerable to bycatch?

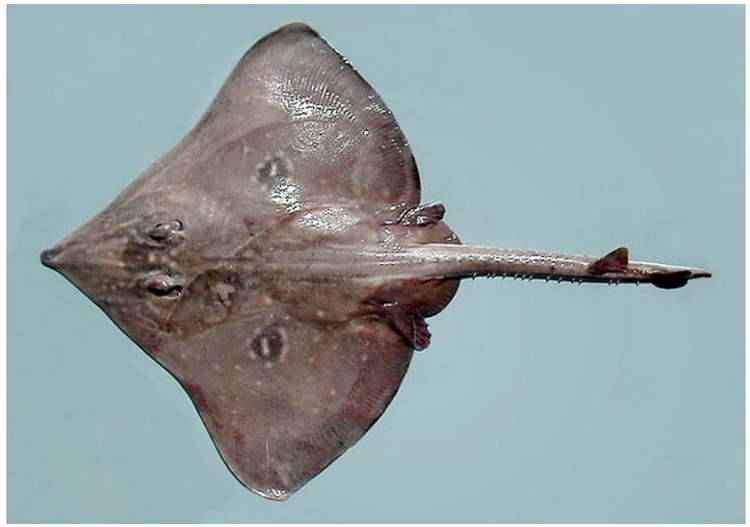
(e.g. habitat, movement, feeding behaviour, size)

CIBBRINA

Common blue skate | Behaviour and biology

C

information



Source: Cambraia Duarte | P.M.N. © ImagDOP

Bycatch Mitigation and the Common blue skate (*Dipturus batis*): Understanding Behaviour and Biology to Reduce Accidental Catch

The Common blue skate, once widespread across the Northeast Atlantic, is now critically endangered due to decades of overfishing and high vulnerability to bycatch. Because of its benthic lifestyle, slow reproduction, and specific habitat preferences, it is frequently caught accidentally in bottom-trawl and some gillnet fisheries (bottom set). Effective bycatch mitigation must begin with a deeper understanding of its biology and behaviour.

Bottom-dwelling behaviour and passive hunting:
Common blue skates live on or near the sea floor, often at depths of 60 to over 600 meters. They remain motionless for long periods, buried in the sediment to ambush prey like crustaceans and small fish. This sedentary behaviour and camouflage make them highly vulnerable to bottom-contact fishing gear, including beam trawls and demersal gillnets.

Large size and late maturity:
The Common blue skate can reach over 2 meters in length and live for more than 50 years. It matures slowly and produces relatively few offspring. These life history traits mean that populations recover extremely slowly once depleted. Even low levels of bycatch can have negative long-term effects on population viability.

Limited movement and site fidelity:
Unlike highly migratory species, Common blue skates show relatively limited movement and often remain within specific habitat ranges for long periods. This increases the effectiveness of localised conservation measures but also means that heavily fished areas can have a disproportionate impact on regional populations (**Source: SWE**).

B

Common blue skate | Distribution

information



Depth range:
20–600 m (most sightings 50–200 m)

Distance from shore:
continental shelf and upper slope, typically within 100 km of coast

Distribution data supplied by the Ocean Biodiversity Information System (OBIS)
marlin.ac.uk/species/detail/1436

A

Common blue skate | Profile and anatomy

working sheet

General features

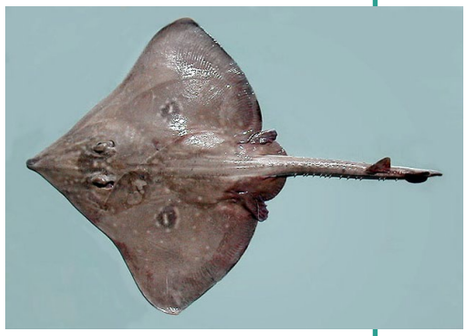
family:

size:

weight:

colour:

life expectancy:



Nutrition

food:

hunting behaviour:

Reproduction

gestation period:

birth:

rearing:

Special features

behaviour:

protection status:

threats:

Distribution and habitat

occurrence:

habitat:

position in the water & diving depth:

distance from shore:

Which characteristics or behaviours make this species especially vulnerable to bycatch?

(e.g. habitat, movement, feeding behaviour, size)

Basking shark | Behaviour and biology

information



Source: Greg Skomal | NOAA Fisheries Service © Wikimedia Commons

Bycatch Mitigation and the Basking Shark (*Cetorhinus maximus*): Understanding Behaviour and Biology to Reduce Accidental Catch

The basking shark, the second-largest fish in the world, is particularly vulnerable to bycatch due to its slow movement, surface-feeding habits, and tendency to inhabit areas also frequented by fishing activity. Effective bycatch mitigation starts with understanding the biological and ecological traits of this species.

Slow movement and surface behaviour:
Basking sharks are slow, passive swimmers that often glide near the surface with their mouths open to filter plankton from the water. This behaviour makes them especially susceptible to entanglement in pelagic trawl nets and surface gillnets. Because they spend significant time feeding at or near the surface, they are at higher risk than faster, deeper-diving species.

Large body size and low manoeuverability:
With body lengths reaching up to 10 meters, basking sharks have limited agility. This makes it difficult for them to escape once they encounter fishing gear. Their size also means that when they are caught, escape or release can cause serious injury or mortality — even if they are returned to the sea.

Migration patterns and predictable habitat use:
Basking sharks follow seasonal migration routes that are increasingly well-documented through satellite tagging. They tend to aggregate in coastal feeding areas, particularly during spring and summer. These hotspots — such as the west coast of the UK and the Bay of Biscay — often overlap with intense fishing activity. By identifying and avoiding these areas seasonally, fisheries can greatly reduce bycatch.

B

Basking shark | Distribution

information



Depth range:
0–1000 m+ (mostly 0–10 m when feeding)

Distance from shore:
inshore bays to outer shelf/slope, up to ~50 km offshore; seasonal coastal aggregation

Distribution data supplied by the Ocean Biodiversity Information System (OBIS) https://www.marlin.ac.uk/species/detail/1438

A

Basking shark | Profile and anatomy

working sheet

General features

family:

size:

weight:

colour:

life expectancy:



Nutrition

food:

hunting behaviour:

Reproduction

gestation period:

birth:

rearing:

Special features

behaviour:

protection status:

threats:

Distribution and habitat

occurrence:

habitat:

position in the water & diving depth:

distance from shore:

Which characteristics or behaviours make this species especially vulnerable to bycatch?

(e.g. habitat, movement, feeding behaviour, size)

Task 3

The distributions of ETP species and fishing activity

task

Individual work

A. Look at the information sheets about the fishing methods. Choose one area of the world where at least two of the ETP species occur and find out which fishing activities take place there. Mark this area on your map.

Group work

B. Compare your results with your classmates. Discuss which fishing methods are most likely to cause bycatch in your selected area and why.

C. Using the fact sheets for each species and the information from your research about the fishing activities in your selected area, check if they are found at the same depths in the ocean and at the same distances from the coast. Write your findings in fields 1 and 2 of the table.

D. Decide which animal species is most at risk from which fishing method. Create a simple colour code for your results: red = very high risk, yellow = low risk, green = not at risk. Colour your results in field 3 of the table and explain why you chose each colour.

Pelagic trawling (mid-water trawl)

information



Typical target species & example fisheries

- Atlantic mackerel (*Scomber scombrus*) – extensive Scottish pelagic-trawl fishery, Northern Atlantic
- Alaska pollock (*Gadus chalcogrammus*) – U.S. pelagic trawl fishery, Northern Pacific
- Cape horse mackerel (*Trachurus capensis*) – adults caught with mid-water trawlers – Southwest Africa
- Jack mackerel (*Trachurus spp.*) – majority of catch from mid-water trawling – Alaska to California

Sources

ices.dk; fisheries.noaa.gov; grocentre.is; mpi.govt.nz

Otter board trawl (bottom trawling)

information



Typical target species & example fisheries

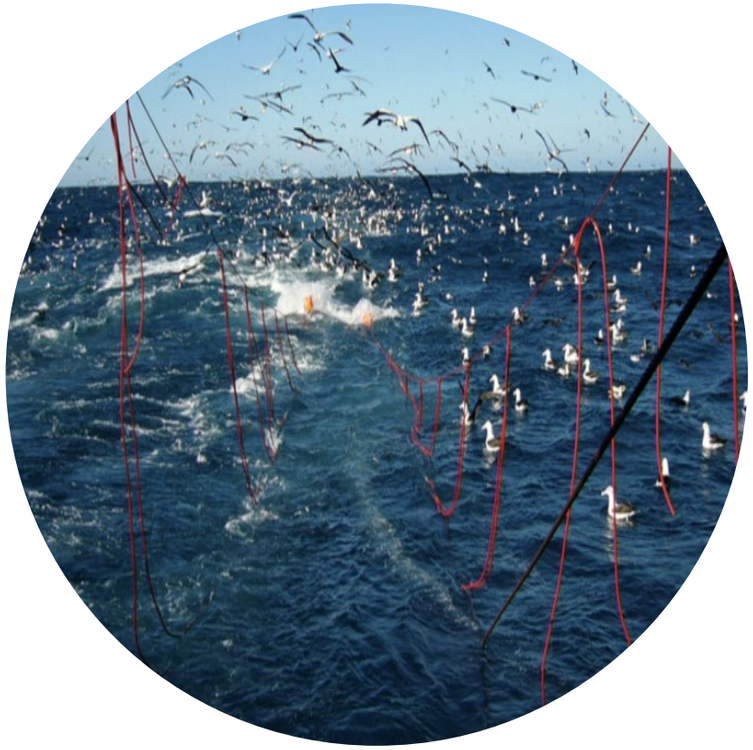
- Mixed demersal species – highly concentrated in European waters (North Sea), but also the Grand Banks (Newfoundland). Primarily on continental shelves and slopes, with 99% of activity concentrated in coastal nations' Exclusive Economic Zones (EEZs)
- Orange roughy (*Hoplostethus atlanticus*) – deep bottom trawl – Northern Atlantic, between New Zealand/Australia. 33% of the 2003 catch from bottom trawls – principal gear

Sources

ices.dk; mpi.govt.nz; openknowledge.fao.org; fao.org

Longline fishing (surface and bottom)

information



Typical target species & example fisheries

- Surface longline – swordfish, blue shark (EU fleet), oceanic tunas – Northeast Atlantic, Mediterranean Sea
- Swordfish – majority of landings by surface-drifting longlines
- Patagonian toothfish – international demersal longline fisheries – Antarctic (South America)
- Greenland halibut – coastal & offshore harvest mainly by longline – Northern Atlantic/Pacific

Sources

wcpfc.int; iccat.int; fao.org

Gillnet fishing

information



Typical target species & example fisheries

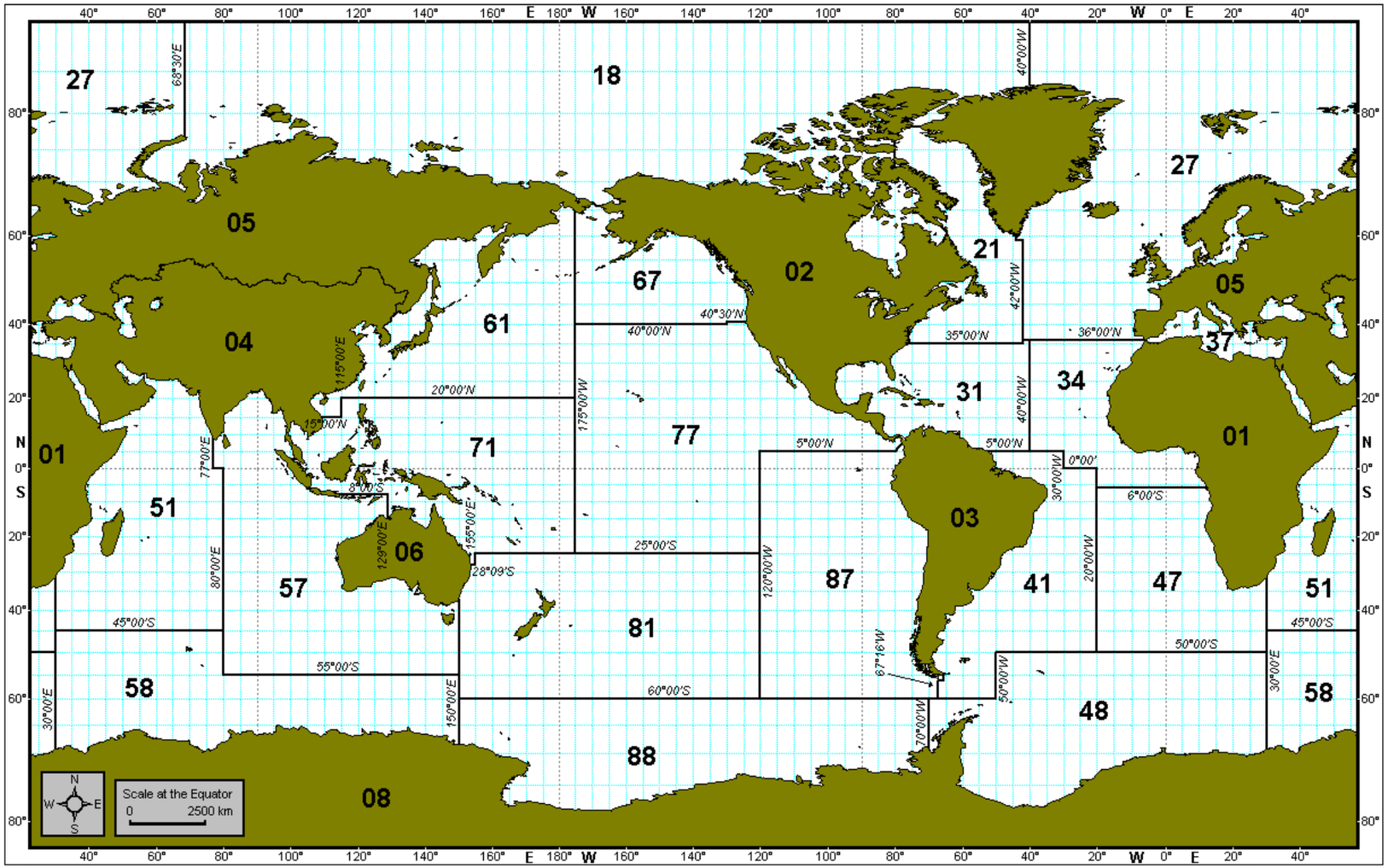
- Sockeye salmon – world’s largest drift-gillnet fishery – Northern Pacific. EU fleets: various species depending on the zone (coastal, bottom, surface, open waters)
- Coastal Atlantic cod fishery – uses demersal gillnets – Northern Atlantic. Hilsa shad – commercial fishery mostly with drift gillnets (~10–12 cm mesh) – Indian Ocean

Sources

fisheries.noaa.gov; europarl.europa.eu; fao.org

working sheet

FAO world map | Use for your research



Which species affected by which fishing method

working sheet

	Pelagic trawling (mid-water trawl)		Bottom trawling		Longline fishing (surface and bottom)		Gillnet fishing	
	Depth range	Distance from shore	Depth range	Distance from shore	Depth range	Distance from shore	Depth range	Distance from shore
Razorbill	no	no	no	no	yes	yes	yes	yes
Loggerhead turtle	yes	yes	yes	yes	no	no	yes	yes
Common dolphin	yes	yes	no	no	no	no	yes	yes
Common blue skate	no	no	yes	yes	no	no	yes	yes
Basking shark	yes	yes	no	no	yes	yes	yes	yes

Task 4

The challenge

task

Individual work

A. Read the reports about each fishing method again.

Group work

B. Explain how the fishing method works. Use the detailed description you have, but shorten it using your own words. Write your version under the section “*How it works*”.

C. Choose one fishing method and choose one animal species that can be caught accidentally with this method. Develop your own *research prompt* to find out *how and why* this fishing method leads to bycatch of your chosen animal. Then, extend your prompt so that it also suggests possible solutions to reduce this bycatch.

D. Design a habitat diagram for your chosen animal species. Select a suitable landscape background and add the typical kinds of flora and fauna that belong to this ecosystem. Show how your species interacts with its environment and mark the fishing methods that pose a high risk.

Pelagic trawling (mid-water trawl)

information

Pelagic Trawling (Mid-water Trawl) is a fishing method designed to catch species that live in the open water, far above the seabed. Instead of dragging the net along the ocean floor, the vessel tows a large net through the middle layers of the sea – usually between 10 and 200 metres below the surface (ICES,2023; FAO, 2021). The exact depth depends on the target species. For example, mackerel and herring are often found nearer the surface, while species like blue whiting may swim in deeper layers.

The net is kept open by large trawl doors that act like underwater wings, spreading it wide. Strong warp wires connect the net to the boat and guide fish towards its opening. Once fish swim inside, the narrowing shape of the net funnels them toward the cod end – a closed-off “bag” at the back – where the fish is collected until the net is hauled. The mesh size determines which fish can escape, in accordance with regulatory mesh requirements. Pelagic trawl nets can be big, as pelagic fish shoals are also very big. This size allows fishers to catch huge schools at once, and there is sometimes a chance of catching non-target species, including marine mammals, turtles, and sharks.

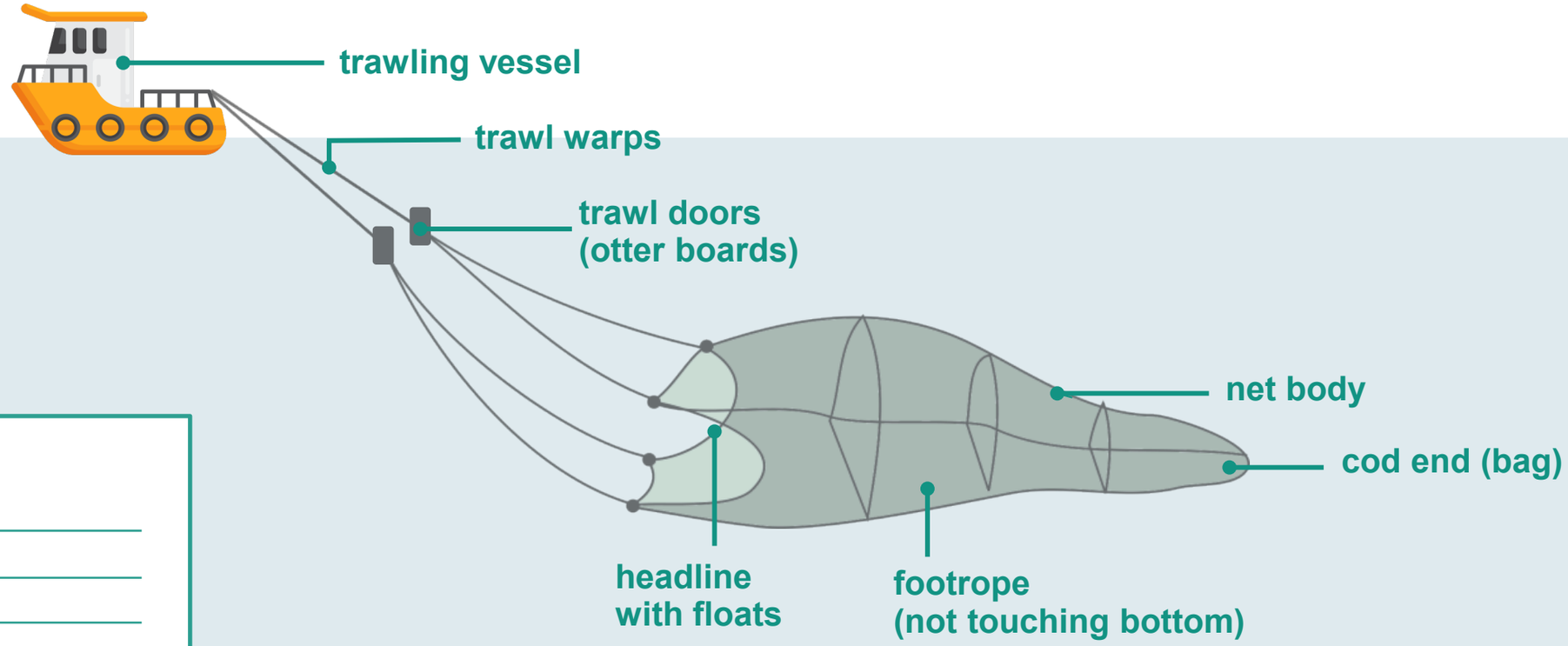
Pelagic trawling usually takes place from just a few kilometres offshore to more than 200 kilometres from land, often along the edges of the continental shelf. These areas are rich feeding grounds where large schools of fish gather, making them prime fishing spots (NOAA Fisheries, 2022).

Pelagic fishing vessels are specialised in catching large quantities of fish, where targeted fishing is possible due to big shoals and the help of echo and sonar equipment.

In particular, in pelagic trawl fisheries bycatch of dolphins can sometimes occur. Further improving effective mitigation requires a detailed understanding of this species' behaviour, ecology, and interactions with fisheries.

Pelagic trawling (mid-water trawl)*

working sheet



How it works

*The design of the fishing gear and vessels shown in these illustrations has been simplified for educational purposes.

Pelagic trawling (mid-water trawl)

information



For labelling

- **trawling vessel** – pulls the net through mid-water (not on the seabed)
- **trawl warp**– long steel cables connecting the vessel to the trawl doors
- **trawl doors** (otter boards) – large, heavy boards that keep the net's mouth open horizontally by hydrodynamic force
- **headline with floats** – the top edge of the net, equipped with floats to keep it at the desired depth
- **footrope** (not touching bottom) – the lower edge of the net; in pelagic trawls, it usually stays clear of the seabed
- **net body** – the tapered, mesh section that channels fish towards the codend
- **cod end (bag)** – the closed end of the net where the catch accumulates; mesh size determines what can escape

Otter board trawl (bottom trawling)

information

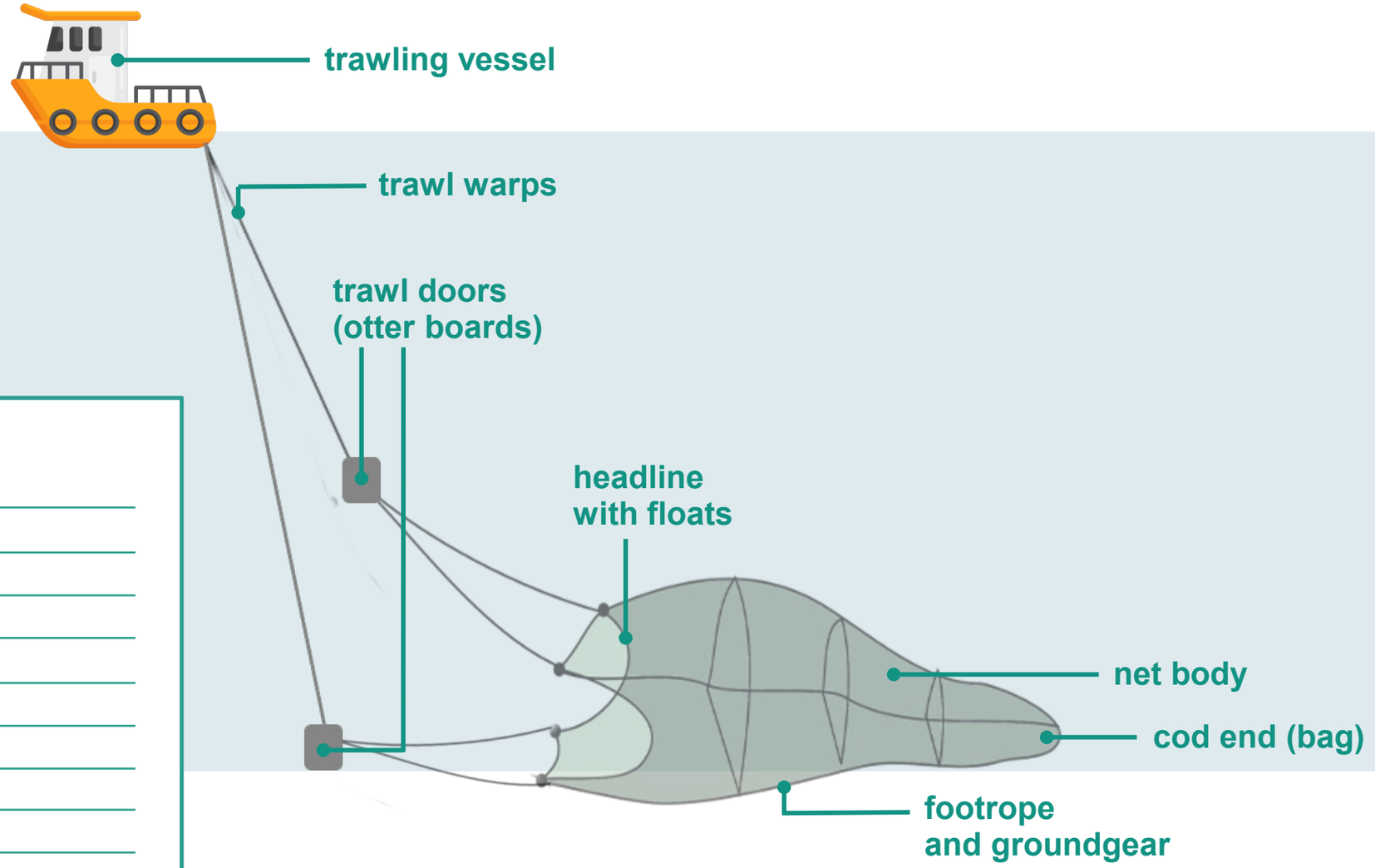
Bottom trawling is a fishing method designed to catch species that live on or close to the seabed. A large, heavy net is dragged along the ocean floor at depths that can range from about 20 metres to more than 1,500 metres (FAO, 2021; ICES, 2022). This technique is used to catch fishes like cod, haddock, flatfish, and deep-water shrimp.

The gear is strong and built to withstand contact with the seabed. Two “otter boards” keep the net’s mouth open horizontally as the vessel tows it forward. Heavy weights and a reinforced ground rope keep the bottom edge of the net in contact with the seabed, herding bottom-dwelling species into the net. Once inside, the fish are guided down the tapered body of the net towards the codend, a closed section at the back where they are trapped.

Bottom trawling takes place both nearshore—on continental shelves targeting shallow-water species—and far offshore, on deep-sea slopes, for species like orange roughy. However, because the net scrapes along the seabed, it can disturb and damage sensitive habitats like coral reefs, sponges, and seagrass beds. It can also catch non-target species such as rays, sharks, and turtles if they live, feed, or rest near the seabed.

Otter board trawl (bottom trawling)*

working sheet



How it works

*The design of the fishing gear and vessels shown in these illustrations has been simplified for educational purposes.

Bottom trawling (otter board trawl)

information



For labelling

- **trawling vessel** – pulls the net along the seabed to catch fish and other species living on or near the seafloor
- **trawl warps** – long steel cables connecting the vessel to the trawl doors
- **trawl doors** (otter boards) – heavy boards that keep the net's mouth open horizontally while it is dragged along the seafloor
- **headline with floats** – the top edge of the net; floats keep it from digging too deep into the sediment
- **footrope and groundgear** (touching bottom) – the lower edge of the net, weighted to maintain contact with the seabed and herd bottom-dwelling fish into the net
- **net body** – the long, tapered mesh that guides fish toward the codend
- **cod end (bag)** – the closed end of the net where the catch collects; mesh size controls which fish can escape

Longline fishing (surface and deepwater)

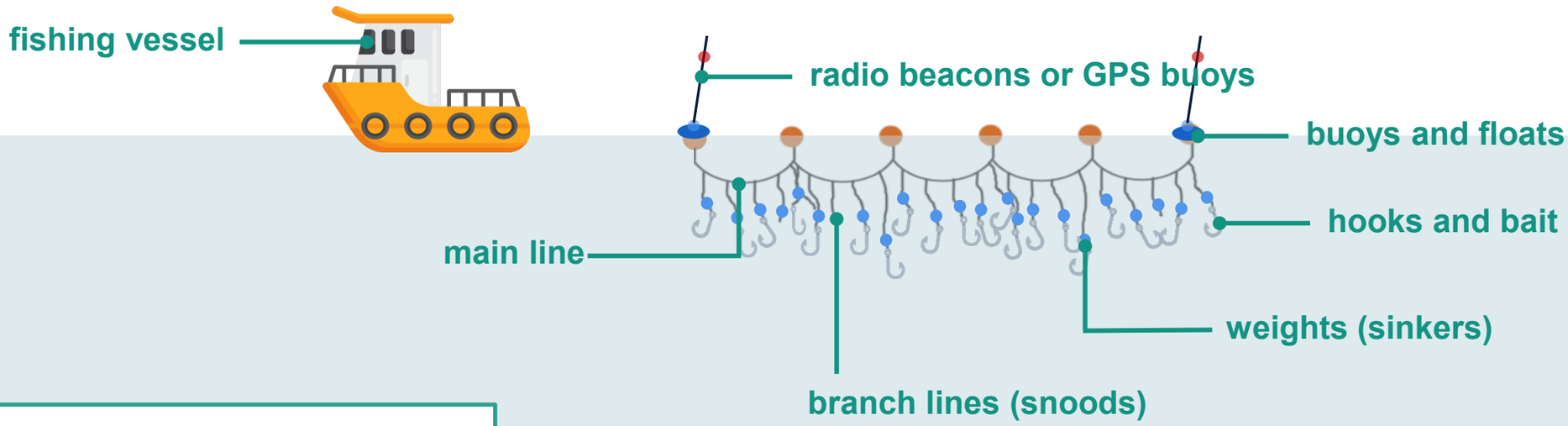
information

Longline fishing uses a long main fishing line that can stretch for many kilometres, with thousands of baited hooks hanging from shorter branch lines called snoods. The method can be adapted to target different species: surface longlines are used for tuna, swordfish, and other pelagic predators, while bottom longlines target species like halibut and snapper (FAO, 2021; WCPFC, 2023).

In surface longlining, the main line floats a few metres below the surface, but can be set as deep as 100 metres, often tens or even hundreds of kilometres offshore. In deepwater longlining, the gear rests directly on or just above the seabed, at depths typically between 50 and 500 metres.

While very effective, longlining also poses some risks for non-target marine animals. Seabirds may dive to take the bait and get hooked; turtles can mistake bait for food and swallow hooks, leading to injury or death; and sharks may be caught accidentally when they are attracted to the bait. Surface, demersal and deepwater longlines pose different risks of bycatch, depending on the depth and species living there. All in all, seasonal migrations, feeding aggregations, or breeding seasons can make bycatch more likely if fishing overlaps with these vulnerable periods.

Longline fishing (surface)*



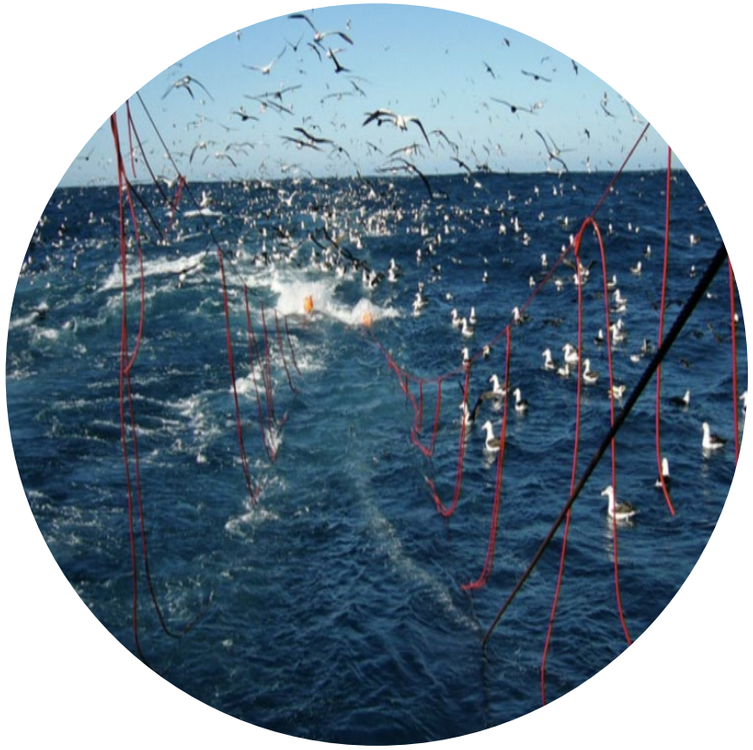
working sheet

How it works

*The design of the fishing gear and vessels shown in these illustrations has been simplified for educational purposes.

Longline fishing (surface)

information



For labelling

- **fishing vessel** – sets and retrieves the longline gear, either at the surface or along the seabed
- **main line** – a strong, central line that can stretch for many kilometres
- **branch lines** (snoods) – shorter lines attached at intervals along the main line, each holding a hook
- **hooks and bait** – used to attract target species; bait type depends on the species being fished
- **buoys and floats** – keep surface longlines at the correct depth or mark their position; may also be used to lift parts of the gear off the seabed
- **weights** (sinkers) – used in demersal (bottom) longlining to keep hooks on or near the seabed
- **radio beacons or GPS buoys** – help fishers locate and retrieve longlines over large distances

Gillnet fishing

information

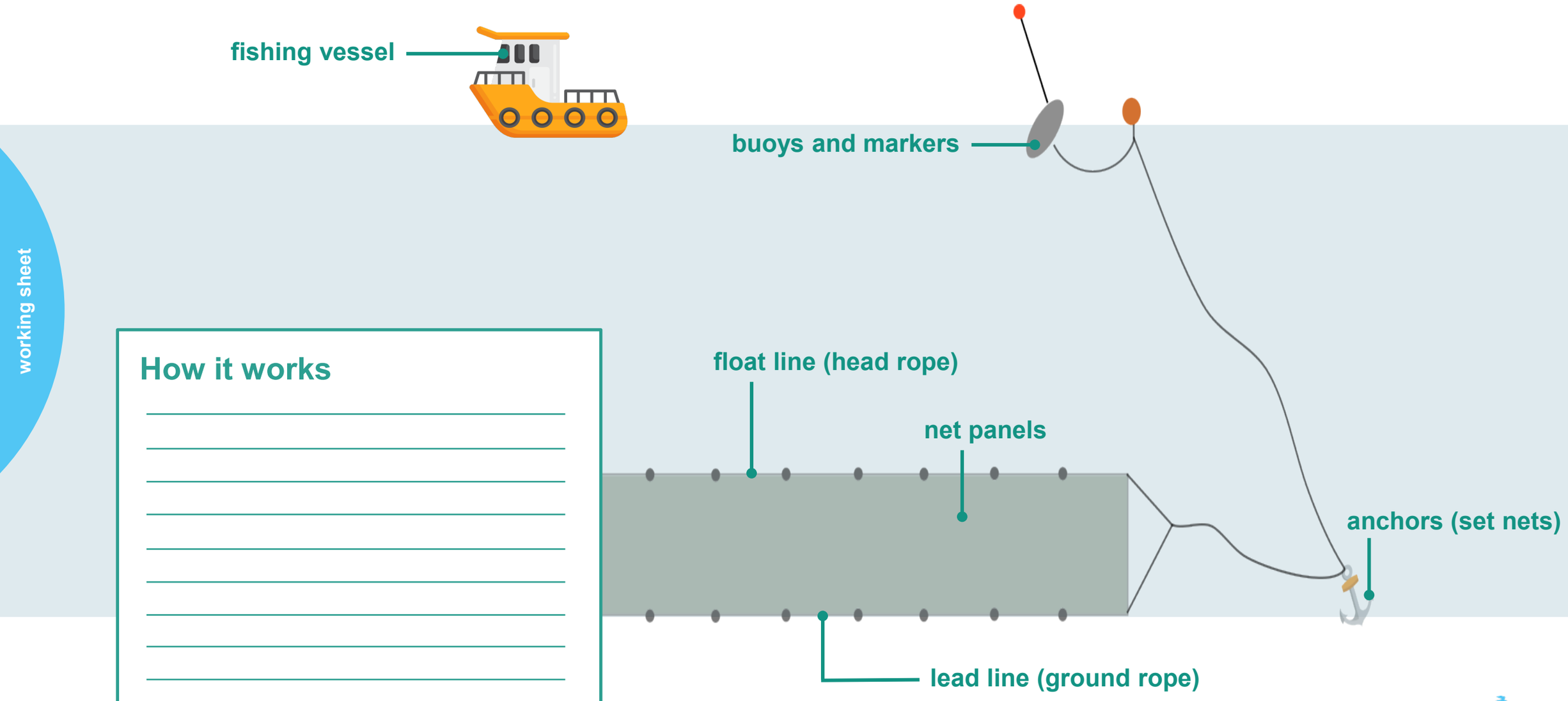
Gillnets are long vertical walls of netting that hang in the water column. They can be very diverse. They can be anchored to the seabed as **set nets** or allowed to drift freely with the currents as **drift nets**. Fish that swim into the net try to back out, but their gill covers get caught in the mesh, holding them fast (NOAA Fisheries, 2022; FAO, 2021).

The position of a gillnet depends on the species being targeted: it can float near the surface, hang in mid-water, or rest along the seabed. Coastal fisheries may place set nets only a few kilometres from shore, while drift nets can be used much further offshore, sometimes tens of kilometres away. These different modalities of gillnets do not pose the same sort and amount of risk. Risk is determined individually by the gillnet's location and species occurring in the area.

Gillnets are simple to use and can be very efficient, but they can also trap non-target species. Dolphins, porpoises, seals, and even whales can become entangled, as well as diving seabirds and turtles. Seasonal animal movements into fishing areas—for example, during migrations or breeding—can significantly increase the risk of bycatch.

Gillnet fishing*

working sheet



How it works

*The design of the fishing gear and vessels shown in these illustrations has been simplified for educational purposes.

Gillnet fishing

information



For labelling

- **fishing vessel** – deploys and retrieves the gillnet gear, either fixed in place or drifting
- **net panels** – vertical walls of netting made of fine, strong twine; mesh size determines which fish are caught
- **float line** (head rope) – the top rope of the net, fitted with floats to keep it upright in the water
- **lead line** (ground rope) – the bottom rope of the net, weighted to keep the net stretched downwards
- **anchors** (set nets) – used to hold the net in position on the seabed in fixed-net fishing
- **buoys and markers** – show the position of the net to fishers and other vessels

Using sources responsibly | Internet & AI

information

Check your sources
- Ask: *Who wrote this?* (author, organisation, institution).
- Trust **official**, **scientific**, or **educational** websites.
- Be careful with blogs, forums, or random videos – they may be opinions, not facts.

Cross-check
- Compare information from at least two different sources.
- If both agree → it's more likely to be reliable.

Signs of a trustworthy source
- Clear author or institution is named.
- Up-to-date (check the year of publication).
- References or links to original data/studies.
- Neutral language (not sensational or emotional).

Using AI (ChatGPT, Lumo, Le Chat …)
- AI can **summarise**, **explain**, or **simulate** ideas.
- But: AI sometimes invents information. Always **verify with trusted sources**.

Use your own words
- Do not copy-paste. Summarise to show understanding.

Be transparent
- Always mention where you got the information (website, book, AI).

Prompt development

information

How you do it

Imagine you are asking an AI or an expert scientist.

Your prompt should contain:

- The name of the **fishing method**
- The name of the **animal species**
- A request to explain **how the interaction happens** (depth, distance from shore, animal behaviour, seasonal patterns, risks).

Example of prompting

A **prompt** is a clear instruction you give to an AI or a research tool so it knows exactly what information you want.

A good prompt:

- **Names the topic** you are interested in.
- **Adds specific details** you want included.
- **Explains the format** you want the answer in (paragraph, list, table, etc.)

Example task:
Let's imagine you want to learn about the diet of the basking shark.

A **weak prompt** might be:
Tell me about sharks.

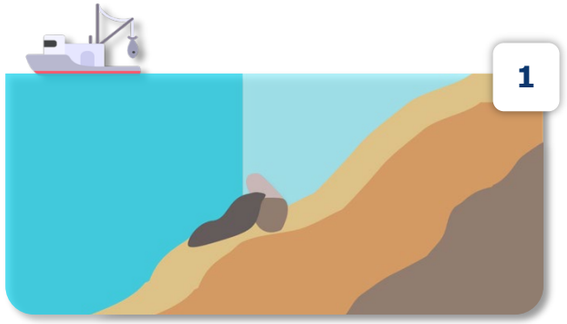
This is too general — you might get information you do not need.

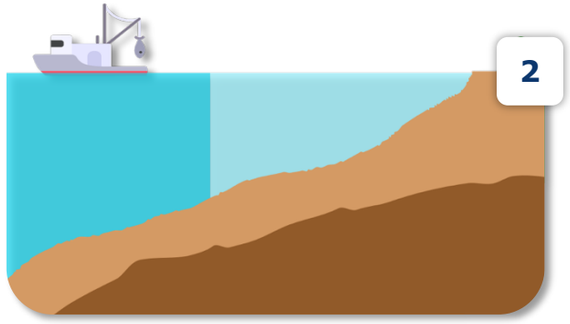
A **better prompt** could be:
Explain what basking shark eats. Include their main food sources, how and if their diet changes with the seasons, and any strategies to get their food. Write the answer as a short paragraph.

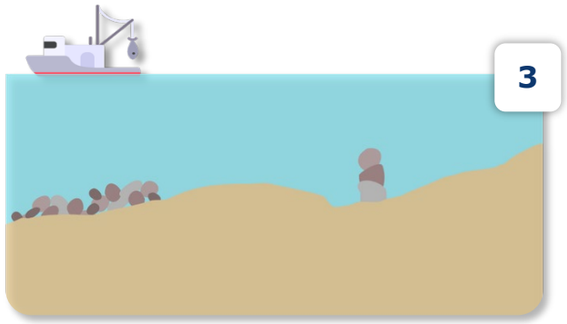
Habitat

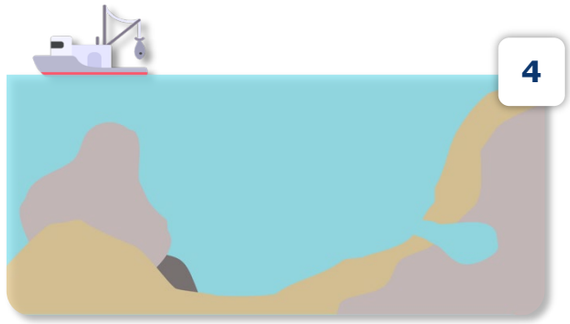
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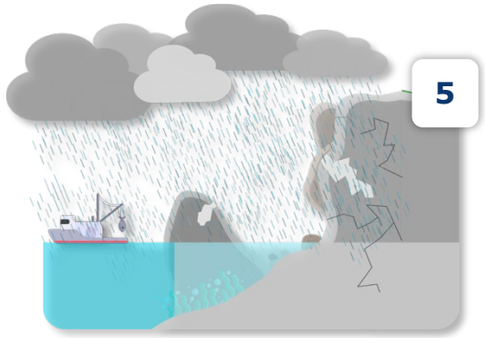
Choose the right habitat for your animal species!



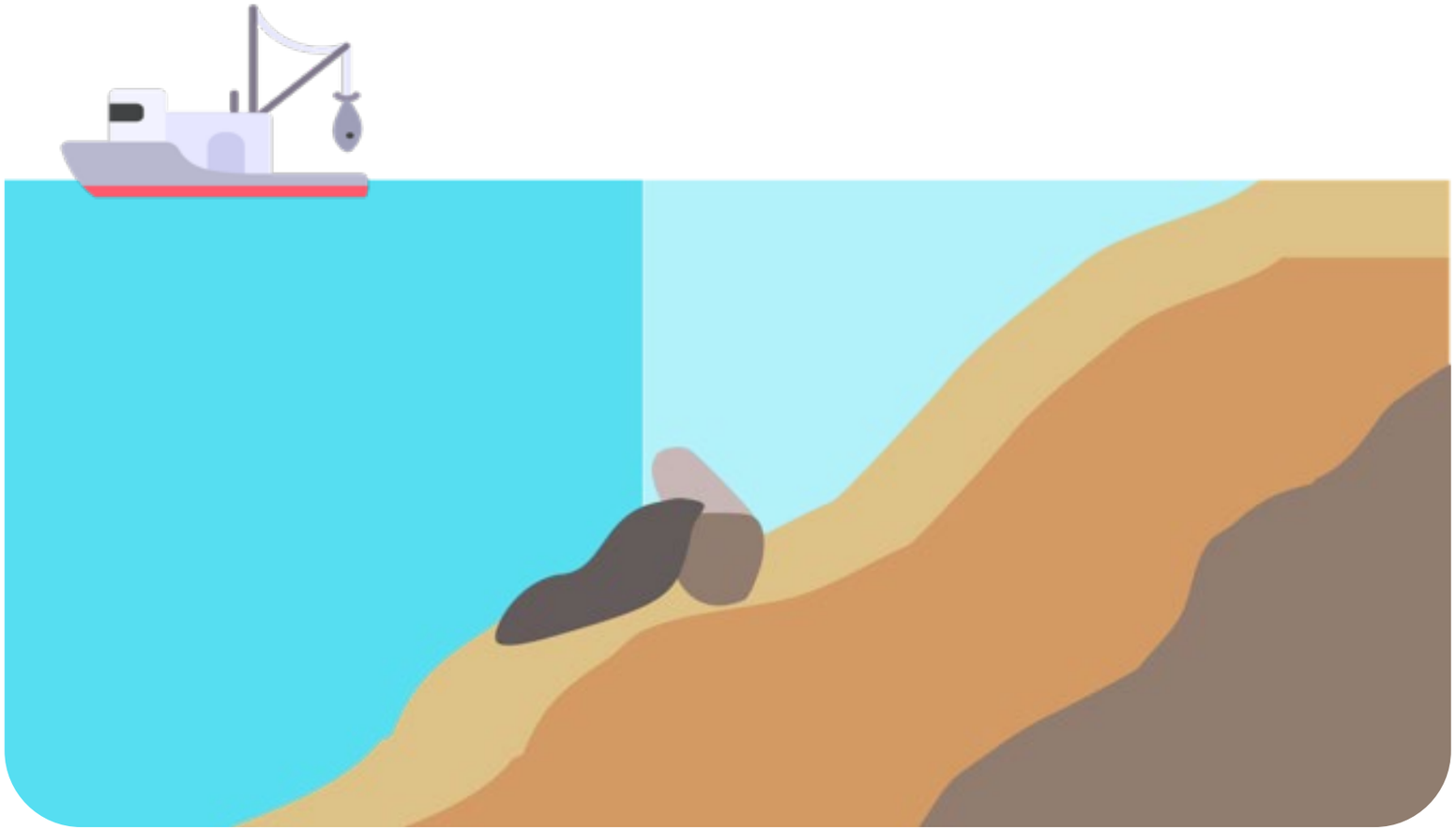






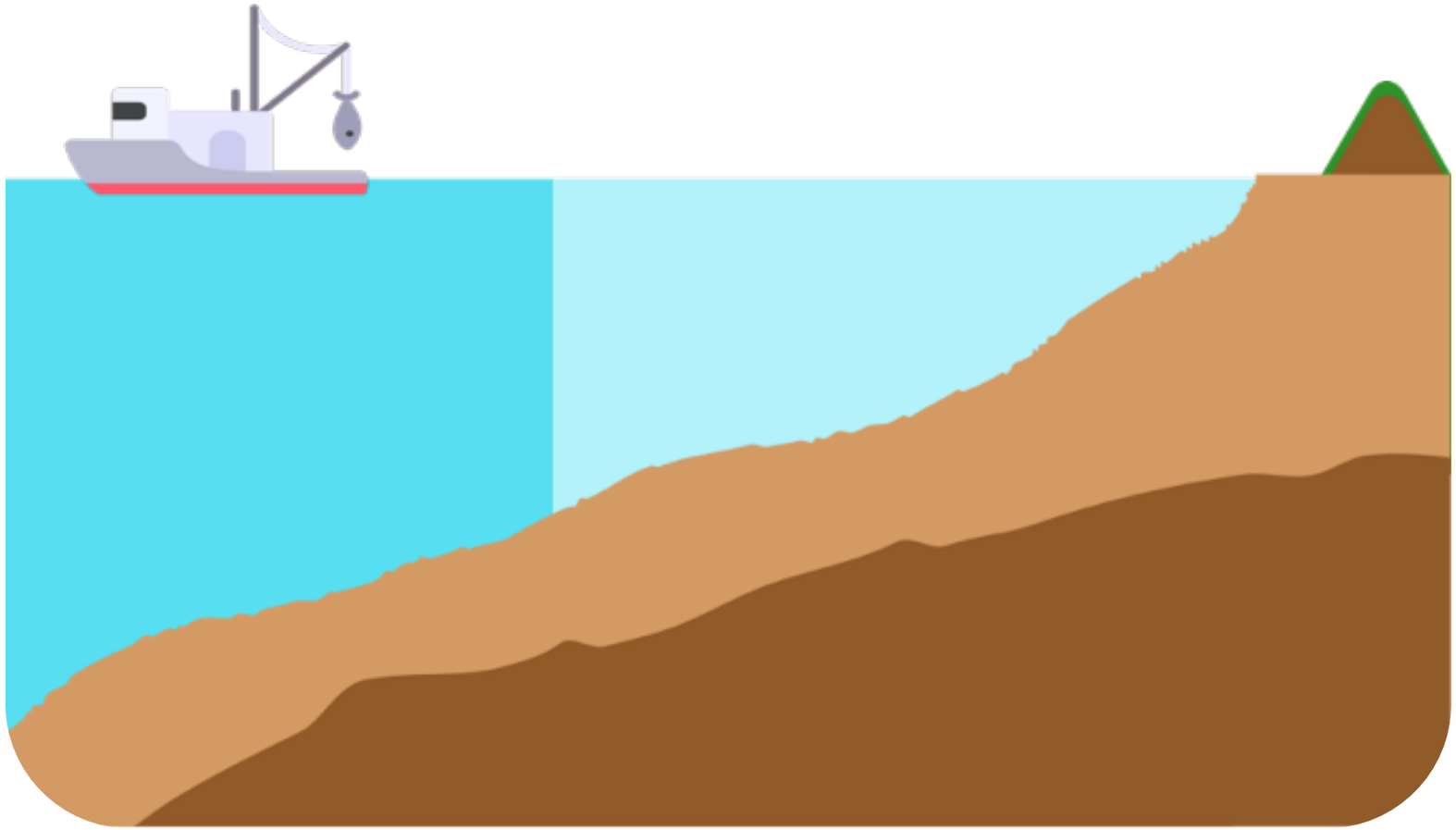


Habitat 1



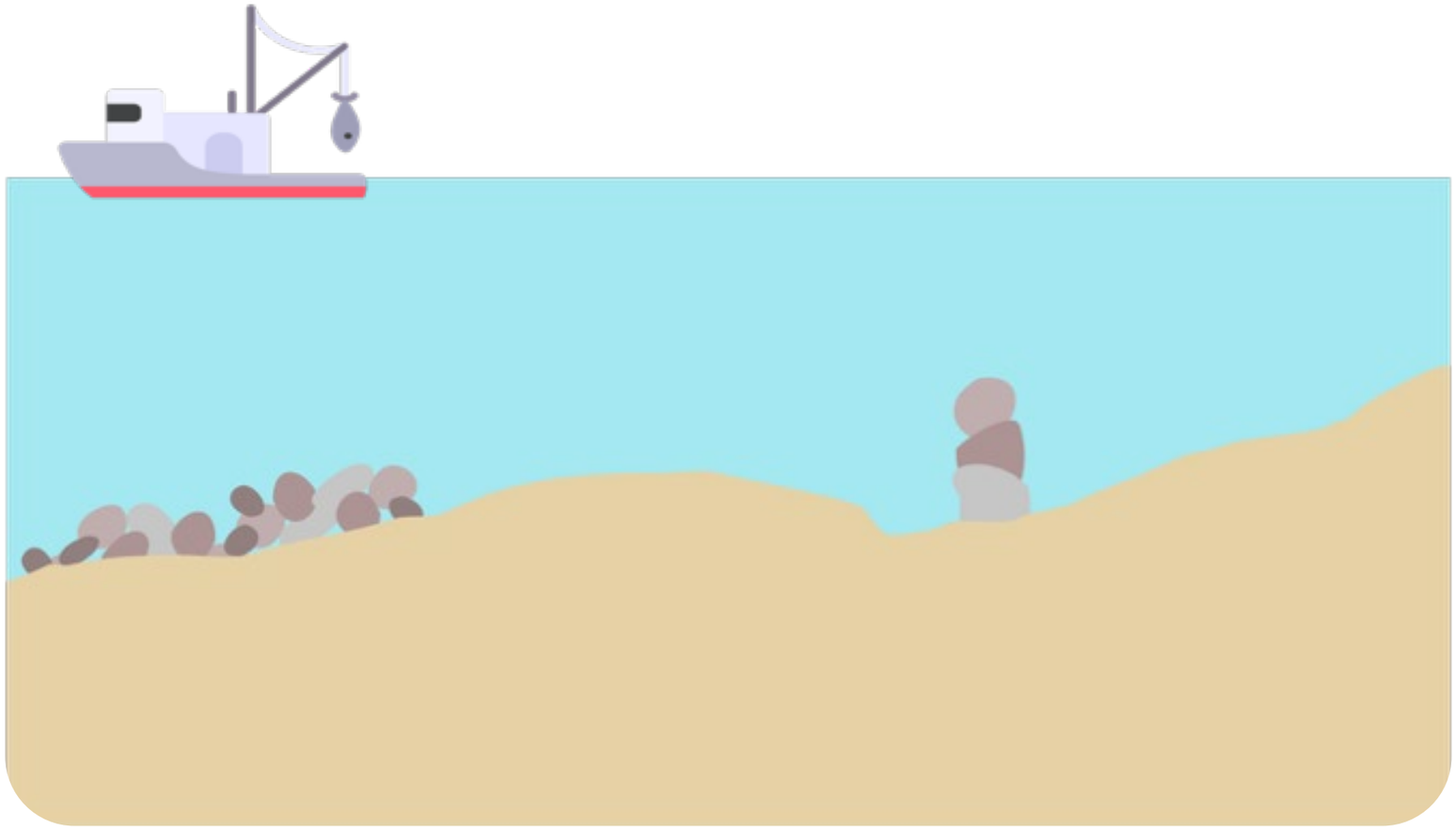
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Habitat 2



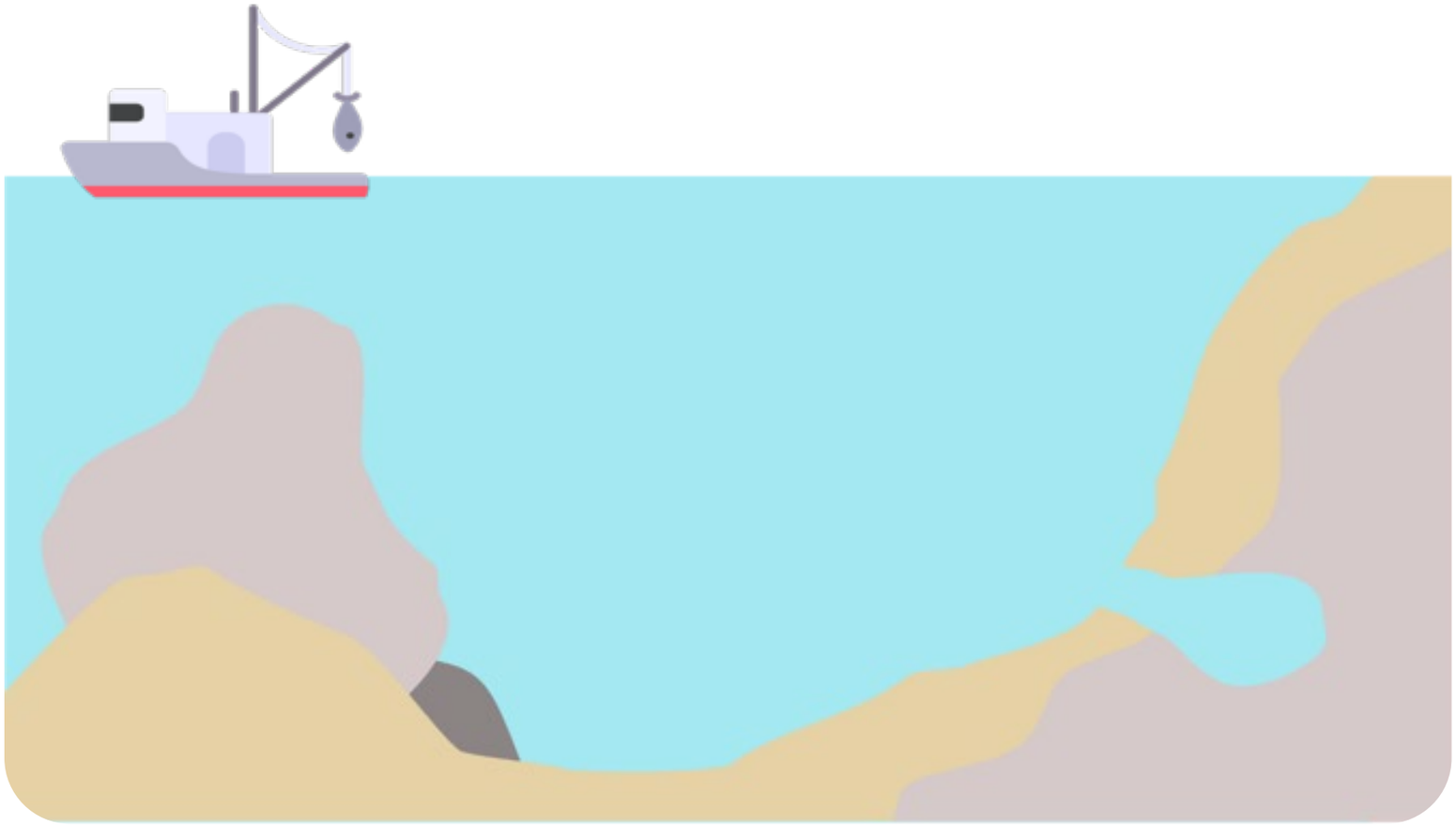
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Habitat 3



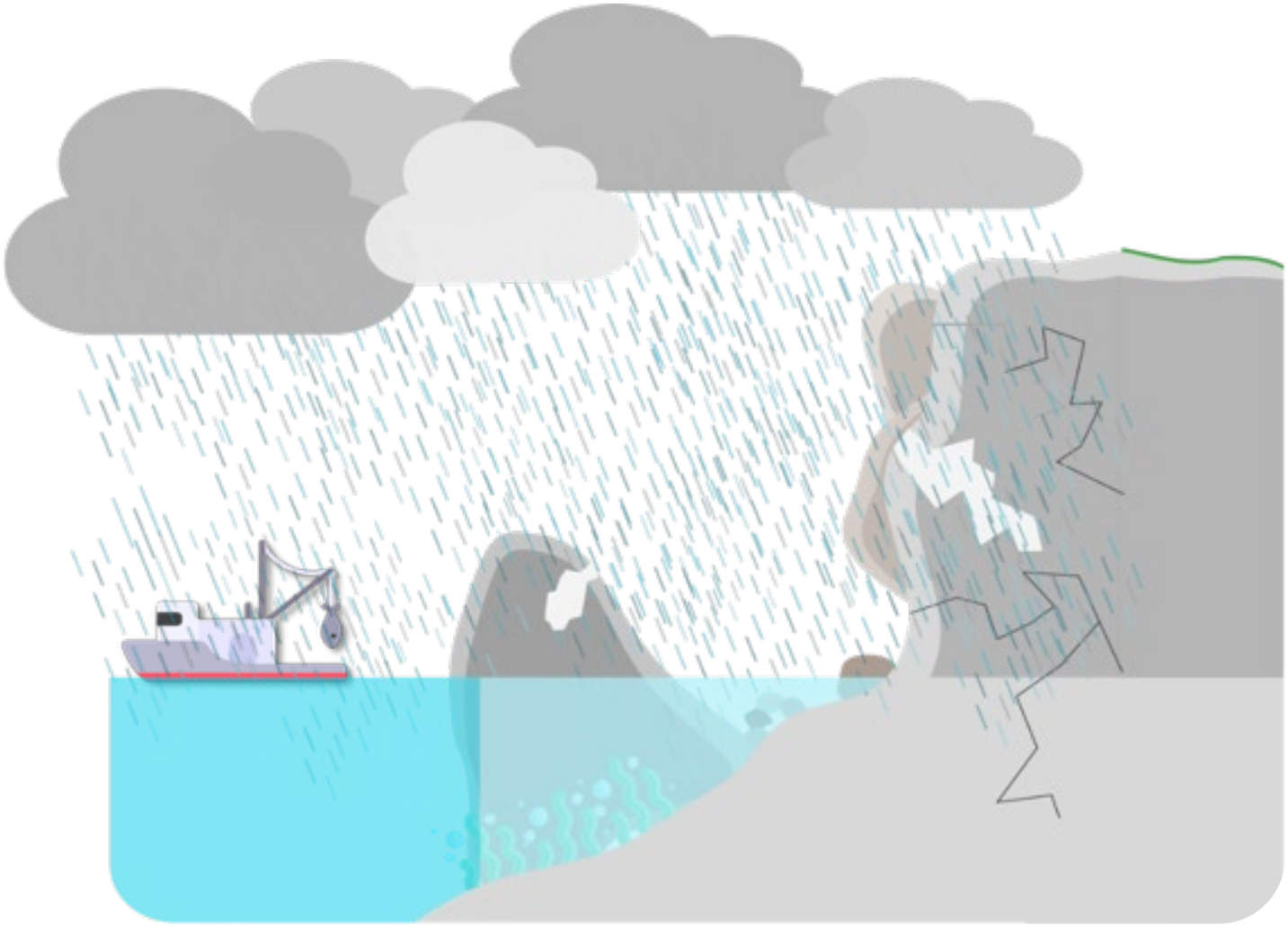
working sheet

Habitat 4



working sheet

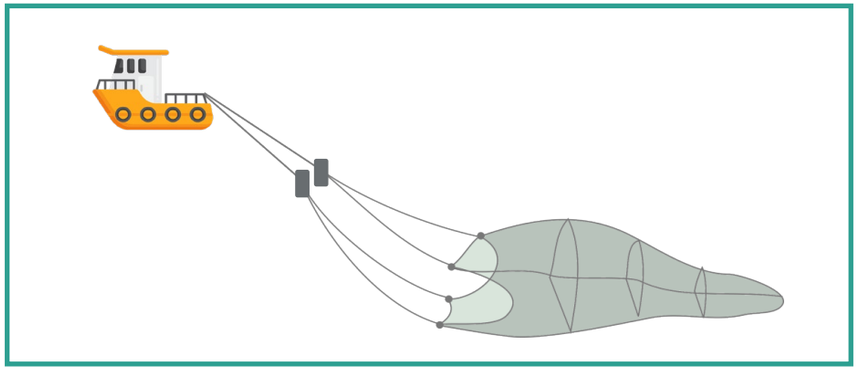
Habitat 5

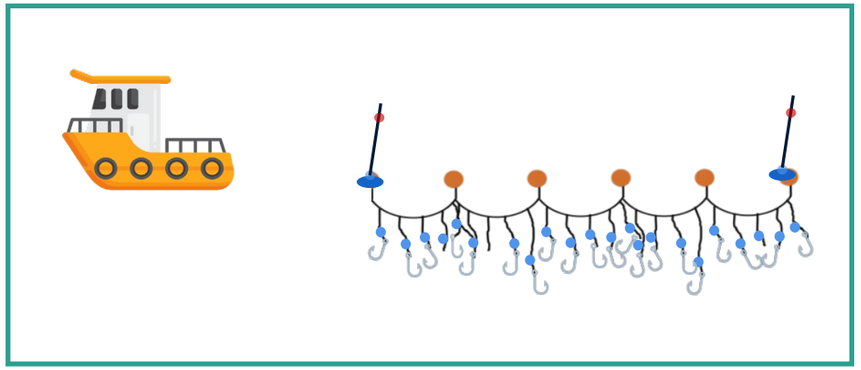


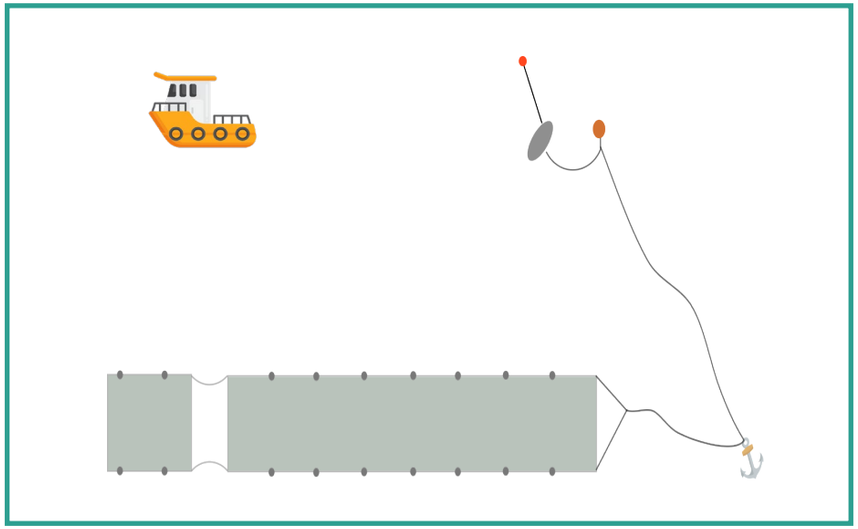
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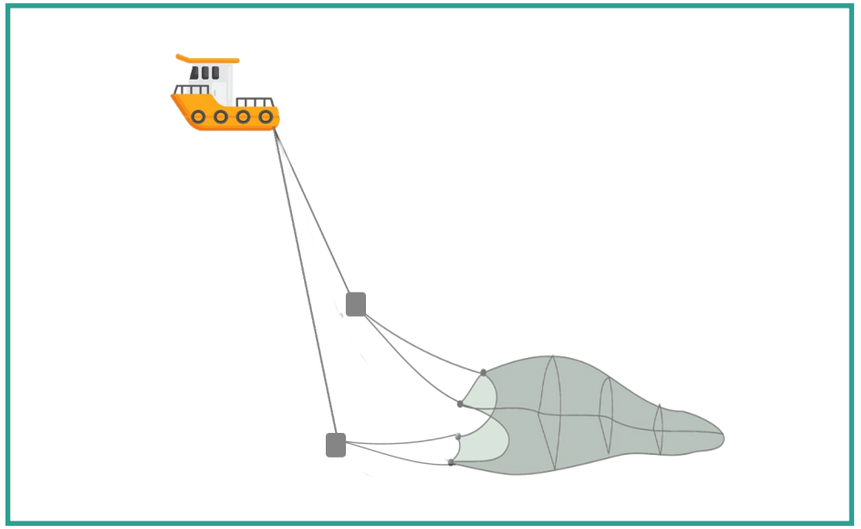
working sheet

Choose the fishing method that poses the greatest risk to your species.





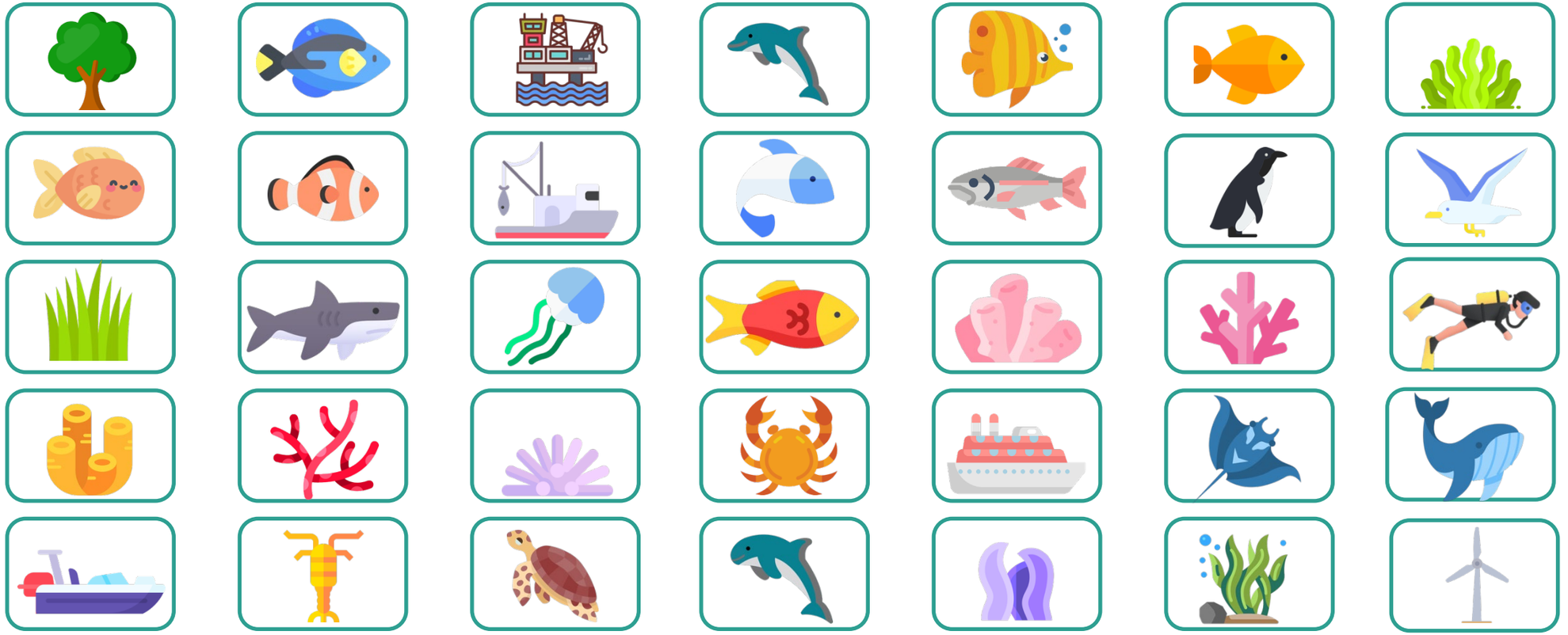




working sheet

Elements for the living space

Use the elements to bring your living space to life.



Assembly instructions for your model

information

Materials



base plate: wood, cardboard, polystyrene (30x30 cm)



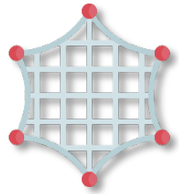
paint and brushes



model boat



modelling mass: plasticine or clay



mesh material



glue



natural materials: small twigs, stones, sand



cartons for figures or structures

Assembly instructions for your model

information

1. Prepare the base plate

A. Coat the base plate with paint to simulate the seabed or water surface.
B. Advice: blue and green colours for water, sandy or brown tones for the seabed.

2. Design living space

A. Place the natural materials such as small stones or sand to represent the soil texture.
B. Model landscape elements that symbolise the typical habitat of your animal species such as reefs, seaweed, rocks, or sandbanks.
C. Also pay attention to the specific environment, e.g. shallow water or deep sea.

3. Add flora and fauna

A. Construct plants (algae or seaweed) out of paper or plastic straws which you can paint.
B. You can make small cardboard figures for the animals, but it is easier to draw the animals on the cardboard.

4. Add external factors

A. To make the habitat as real as possible, man-made external factors are also included. Here are two examples of how you can integrate these into your model:
    - Drilling platform: Cut a small platform out of cardboard and glue tubes underneath as supporting pillars.
    - Wind turbine: Use a stick as a tower and attach a small cardboard or plastic cross to the top for the rotor blades.

5. Fishing boat and net

A. In the best case, use a model boat, otherwise you can also make a boat out of cardboard.
B. Attach your mesh material to one side of it.
C. Now make sure that you can recognise which fishing method it is.
D. If you attach the net only lightly to the boat with threads, it "floats" in the model and appears to be three-dimensional, so it becomes the main focus of the model.

6. Conclusion and details

A. Paint and decorate the small details (wave structure, shells or small grains of sand) to bring the model to life.

Task 5

Research project

Background

A research project is a structured way to investigate and better understand a specific topic. Researchers ask questions, gather and analyse data, draw conclusions to solve problems and expand knowledge. In environmental science, research can help protect species and ecosystems by identifying threats and proposing solutions.

task

Individual work/group work

A. Plan your own research project step by step for your species – focusing on the problem of bycatch.
Imagine you are part of a marine conservation team. Your task is to design a research project that investigates how bycatch affects your species and what could be done to reduce it.

B. Design a simple review process for your bycatch research project by deciding who will review it, what they should focus on, and how the feedback will be given. On the following pages you will find an explanation of what a review process is.

A research project

information

1 Select topic

- Think about a topic that interests you. It can be from natural sciences, social sciences, technology or another research field.
- Example: "How does music influence the ability to concentrate while learning?"

2 Formulate a research question

- Formulate a specific question that you would like to answer with your project.
- Example: "Does listening to classical music while learning have a positive influence on students' concentration?”

3 Hypothesis

- Formulate a hypothesis that you would like to test through your research.
- Example: "I hypothesise that students who listen to classical music can concentrate better than those who do not listen to music."

4 Planning the method

- Think about how you will collect data. Which experiments, surveys or observations do you want to carry out?
- Example: "I will observe two groups of students learning: one group listens to classical music, the other does not. I will then test their ability to concentrate."

5 Implementation

- Carry out your planned methods and collect data.
- Example: "I let the students study for 30 minutes and then give them a concentration test."

6 Analyse data

- Analyse the collected data and draw conclusions.
- Example: "I compare the results of the concentration tests between the two groups."

7 Present results

- Write a report or create a presentation to present your results. Explain whether your hypothesis was confirmed or not.
- Example: "The students who listened to classical music achieved better results in the concentration test on average."

working sheet

Plan of a research project

1. Choose a topic that interests you

2 & 3. Formulate a research question and a hypothesis

4. Plan the data collection method

5. Prompt for data simulation (next page)

6. Compare your observations or results in a simple way (e.g. using a table or a graph) and say what this means for your hypothesis.

7. Present your results in a short report or presentation.

Prompt for data practice (optional AI use)

working sheet

Fill in your ideas for the first **four steps of the project** (research question, hypothesis, method, what you want to measure) into the fields marked "*insert here*" in the prompt.

It does not matter if you write a **detailed description** or just a **short summary** – the important thing is that all four fields are **completed**.

Then copy your finished prompt and run it in an **LLM of your choice** (e.g. ChatGPT, Gemini, Perplexity,…).

AI is used here only to **simulate example data**, not to answer the research question.

Prompt

"I am working on a small research project. To practice data analysis, please simulate simple example data for me…

- **Research question**: [insert your question here]
- **Hypothesis**: [insert your hypothesis here]
- **Planned method of data collection**: [insert method here, e.g. observation, survey, experiment]
- **What I want to measure or compare**: [insert focus here]

Please generate a small, easy-to-read dataset (in a table) that shows possible results of this research. The dataset should be realistic but simple enough for pupils to analyse. Provide around 5–10 data points and make sure I can use them to confirm or reject my hypothesis."

Review (feedback)

working sheet

What types of review are there?

1. **Peer Review**
   Other students or groups look at your project and give feedback. *Example: Two other groups in your class review your findings.*

2. **Teacher Review**
   A teacher checks your work for accuracy, structure, and clarity.

3. **Self Review**
   You or your group review your own project again — do you find any unclear parts or missing information?

4. **External Review**
   Someone outside school (like an expert or even a fisher) gives feedback — for example, on how realistic your ideas are.

Task

Design a **review process** for your own research project on **bycatch**.

Answer these questions:

- **Who should review your work**? (e.g. other groups, teacher, expert)
- **What should they focus on**? (e.g. clarity, realistic solutions, accurate facts)
- **How will the review happen**? (e.g. feedback form, oral comments, written notes)

Review | process

Task 6

Evaluating and discussing bycatch measures

task

Group work

A. Discuss the following questions:

Which of the measures seem the most effective? Why?

- Which measures might be the easiest to accept for fishers? Why?
- Which measures need the strongest control to be successful?
- Which ones do you personally find most convincing?

Collect the results on the board

Technical solutions

information

Turtle Excluder Device (TED)

How does it work?
A grid is built into the trawl net. Large animals like turtles or dolphins hit the grid and escape through a special opening. Smaller fish and shrimp pass through and are caught.

Which species does it protect?
Mainly sea turtles, dolphins, sharks and other large marine animals.

Do the measures work?
Yes, TEDs are very effective when correctly installed. They reduce turtle bycatch by up to 90%. They work best in shrimp trawl fisheries.

Effect on target catch:
Normally only a small reduction in shrimp catch (2–5%).

What is needed for monitoring?
Regular checks that TEDs are fitted correctly and not blocked. Observers or cameras can ensure compliance.

Advantages / disadvantages:
✅ Highly effective, simple technology.
❌ Fishers may fear losing part of the target catch.

Pingers (Acoustic deterrents)

How does it work?
Small devices on nets send out sounds. These keep dolphins and porpoises away from the nets.

Which species does it protect?
Mainly whales, dolphins, porpoises and seals.

Do the measures work?
Effectiveness depends a lot on species, fishery, location, etc. They can significantly reduce bycatch of porpoises and dolphins, but only if devices are used correctly. Habituation of the animals can occur with some species.

Effect on target catch:
No direct effect – target fish are still caught.

What is needed for monitoring?
Regular checks that pingers are switched on and working. Data collection on bycatch rates to measure effectiveness.

Advantages / disadvantages:
✅ Cheap and easy to apply.
❌ Noise pollution and resulting acoustic stress, deterrence from feeding and birthing grounds and resting areas; animals can adapt to the sound and become indifferent to pingers.

Technical solutions

information

Circle Hooks

How does it work?
Hooks are designed in a circular shape rather than a J-shape. This reduces the chance that turtles or other large animals swallow the hook, because the hook is more likely to catch in the mouth rather than the throat.

Which species does it protect?
Mainly sea turtles, but also sharks and seabirds.

Do the measures work?
Yes, studies show circle hooks can reduce turtle bycatch by 60–90%, depending on the fishery.

Effect on target catch:
Target fish such as tuna and swordfish are still caught, often with little or no reduction.

What is needed for monitoring?
Checks that fishers actually use circle hooks instead of J-hooks.

Advantages / disadvantages:
✅ Very effective, low-cost solution.
❌ Fishers may fear losing part of the target catch.

Bird-Scaring Lines (Tori Lines)

How does it work?
Lines with colourful streamers are attached to boats and extend over the fishing gear. The moving streamers scare birds away, preventing them from diving on baited hooks.

Which species does it protect?
Mainly seabirds such as albatrosses, petrels, and shearwaters.

Do the measures work?
Yes, they can reduce seabird bycatch by up to 90% when used correctly.

Effect on target catch:
No direct effect – target fish are still caught.

What is needed for monitoring?
Observers or cameras to check that bird-scaring lines are deployed correctly.

Advantages / disadvantages:
✅ Simple, cheap, highly effective.
❌ Less effective in very strong winds or rough seas.

Management solutions

information

Move-on rules

How does it work?
If many protected animals are caught, the vessel must leave the area and fish elsewhere.

Which species does it protect?
Migrating animals: turtles, sharks, dolphins.

Do the measures work?
Yes, but only if fishers follow the rule and authorities can check it. Effectiveness depends on how fast and how far fishers **can** react and if they do so alone or with consistent information by all the vessels in the area. It also depends on the distribution of the protected animals.

Effect on target catch:
Can reduce catch because fishers have to leave good fishing grounds.

What is needed for monitoring?
Observers, logbooks, or electronic monitoring to check compliance.

Advantages / disadvantages:
✅ Flexible, reduces bycatch hotspots.
❌ Difficult to control, costly for fishers, depends on their compliance.

Seasonal closures

How does it work?
No fishing in certain areas during sensitive times (e.g. breeding, migration).

Which species does it protect?
Seabirds, mammals, turtles, juvenile fish.

Do the measures work?
Yes, highly effective in reducing bycatch during sensitive seasons. Success depends on correct timing and area choice.

Effect on target catch:
Fishers lose access to certain areas for a limited time → lower short-term catch, but can help sustain stocks long-term.

What is needed for monitoring?
Patrols, satellite tracking of vessels, clear rules and communication.

Advantages / disadvantages:
✅ Strong protection in critical periods.
❌ Loss of income in closure periods.

Monitoring solutions

information

Human observers on board

How does it work?
Trained people join fishing trips and record catch and bycatch.

Which species does it protect?
Indirectly all species → because rules are more likely to be followed.

Do the measures work?
Yes, very effective in gathering reliable data. But works only if enough observers are available.

Effect on target catch:
None. However, the information they gather is essential to deal with the bycatch problem.

What is needed for monitoring?
Funding for observer programs, training, independence of observers.

Advantages / disadvantages:
✅ High-quality data.
❌ Expensive, not possible on all vessels.

Camera systems (electronic monitoring)

How does it work?
Cameras record fishing and catch. Footage is later analysed for bycatch and compliance.

Which species does it protect?
Indirectly all species → by improving transparency.

Do the measures work?
Yes, effective if cameras cover key activities and footage is analysed.

Effect on target catch:
No direct effect but provides a greater quantity of more accurate information, which is essential to address the problem. However, it is not always possible to identify the species from the images.

What is needed for monitoring?
Investment in cameras, storage and review of video data, trust between fishers and authorities. Respect for privacy and data protection law.

Advantages / disadvantages:
✅ Cheaper than observers, 24/7 recording.
❌ Large amounts of data, privacy concerns, image analysis still poses some technical challenges.

Task 7

Final discussion

task

Group work

You have already learned:

- Which fishing methods cause bycatch.
- Which species are affected.
- Which solutions already exist.

Now it is your task to **develop and discuss solutions to the bycatch problem** – but not as yourselves.
Take on the role of different participants in the project (fishers, scientists, consumers, NGOs, politicians).

Final discussion

task

Step 1 – Prepare your role

Read your role card carefully.
Decide: Which bycatch solutions (from the fact sheets) would you **support**? Why?
Which ones would you **reject**? Why?
Prepare **arguments** you can use in the discussion.

Step 2 – Group discussion

In your role, discuss the following questions:

- What are the biggest challenges with bycatch from your perspective?
- Which existing solutions can work best for you? Under which conditions?
- Which new ideas or improvements can you suggest?

Step 3 – Present & debate

Each group presents their main arguments (2–3 minutes).
Afterwards, you will have an open debate where you can ask and answer questions from the perspective of your role.

working sheet

Fisher



Name	Hans Fischer
Occupation	Professional fisher on a medium-sized fishing vessel in the North Sea
Age	45 years
Experience	Over 20 years in the fishing industry

1. Position on bycatch

- Bycatch is a challenge, both morally and economically.
- Fishers try to avoid it, but it is sometimes unpredictable.

2. Problems with bycatch

- Current regulations often feel too strict or not flexible enough.
- New equipment can be expensive and not always practical at sea.
- Bycatch sometimes damages nets and increases costs.
- Bycatch may also represent a serious risk for the crew when the animals have to be handled for release.

3. Concerns about new measures

- Fear that new rules and technologies may slow down work or reduce income.
- New solutions must be tested carefully under real conditions.

4. Everyday life at sea

- Fishing means a lot of weeks away from home, often in bad weather.
- Every catch is important to secure income.
- Fishers must also document catches and bycatch → adds extra workload.
- Limited staff and damaged gear make the job even harder.

5. Possible solutions

- Work best when fishers are directly involved in designing them.
- Need support with training, funding, and fair rules.
- Many fishers are open to testing new tools (e.g. deterrents).

6. Future of fishing

- Sustainable solutions are essential to protect both fish stocks and jobs.
- Balance between environment and economy is key.
- Transition is possible with cooperation, time and support.

working sheet

Scientist



Name	Dr Maria Marine, researcher
Occupation	Marine biologist specialising in sustainable fisheries and marine ecosystems
Age	38 years
Experience	12 years of research in the field of bycatch and protection of endangered marine species

1. Position on bycatch

- Task: measure how much bycatch occurs and which species are mostly affected.
- Main challenge: impact on populations of protected species.
- Science provides data for fair and effective decisions.

2. Problems with bycatch

- Data often incomplete or underreported.
- Hard to assess ecosystem-wide effects.
- Without good data, effectiveness of measures is unclear.

3. Concerns about new measures

- Some tools (e.g. pingers, selective nets) only work under certain conditions.
- Often not used consistently.
- Need for systematic monitoring.

4. Everyday life as a scientist

- Work includes collecting data at sea (on research vessels) and analysing samples in the lab.
- Collaboration with fishers is essential, as their experience improves our data.
- Part of the job: explaining results in an understandable way to policy-makers and to the public.

5. Possible solutions

- Better monitoring tools: e.g. cameras, electronic logbooks, observer programs.
- More selective gear tested under real fishing conditions.
- Close cooperation with fishers to adapt measures to reality at sea.

6. Future of fishing

- Goal: sustainable fisheries based on good science.
- Data-driven management helps balance ecological protection and economic needs.
- Cooperation between scientists, fishers, NGOs and policy-makers is key.

working sheet

Consumer



Name	Anna Nachhaltig
Occupation	Student of environmental sciences
Age	22 years
Experience	Active in an environmental protection organisation + conscious consumer behaviour

1. Position on bycatch

- Bycatch is worrying: many animals die unnecessarily, including endangered species.
- I prefer fish with sustainability labels.

2. Main problems

- Hard to know if fish was caught sustainably.
- Labels and certifications not always clear or reliable.
- Consumers rarely know how much bycatch is involved in different fisheries.

3. Concerns about fishery products

- Industry often seems not transparent.
- Fish is more expensive when certified → hard for students/low income.
- Worry when hearing about accidentally caught turtles, dolphins, sharks, seals, seabirds.

4. Everyday life as a consumer

- Try to buy consciously, but information is confusing.
- Supermarkets do not always show where/how fish was caught.
- Price is important – not everyone can afford certified fish.

5. Possible solutions

- Clearer labels and more transparency.
- Industry and politics should do more to reduce bycatch.
- Support campaigns and education for consumers.

6. Future of fishing

- Hope for more sustainable, transparent fisheries.
- Need affordable, certified products.
- My role: make conscious choices and raise awareness.

working sheet

NGO



Name	Ocean Protect e.V.
Mission	Protection of marine ecosystems and sustainable fisheries
Experience	Active in marine conservation for over 15 years

1. Position on bycatch

- Bycatch is one of the biggest environmental problems in fisheries.
- Millions of animals die each year (including dolphins, turtles, sharks).
- Strong reduction is needed for healthy oceans.

2. Main problems

- Many fishing methods are not selective → high bycatch.
- Protected species are caught and killed accidentally.
- Bycatch reduces fish stocks, endangers rare marine animals, and harms ecosystems.

3. Concerns about fishery products

- Some tools are promising, but not mandatory.
- Enforcement is often weak.
- Industry interests sometimes block stricter rules.

4. Everyday life of an NGO

- Raise awareness with the public and politicians.
- Campaign for stricter laws and sustainable fishing.
- Cooperate with fishers on solutions and monitor compliance.

5. Possible solutions

- Mandatory use of selective gear (e.g. special nets, deterrents).
- Stricter controls and sanctions for non-compliance.
- Promotion of sustainable fishing (financial incentives).
- More transparency in seafood supply chains.
- Protected areas for endangered species.

6. Future of fishing

- Fisheries must become fully sustainable
- Stronger laws and conservation programs are needed
- Aim: species-rich oceans for future generations and healthy ecosystems

Administration and political bodies



Name	Ministry of Fisheries and Environmental Protection
Mission	Development of laws and regulations for sustainable fisheries
Experience	Decades of responsibility for protecting the oceans and securing fish stocks

working sheet

1. Position on bycatch

- Bycatch is a serious issue for marine ecosystems.
- Our duty: protect fish stocks and allow fishers to keep their profession.
- Balance between economy and environment is key.

2. Main problems

- Regulations must work in very different fisheries → not easy to design.
- Controls on the open sea are difficult and costly.
- Too strict rules risk harming jobs, too weak rules will not solve the problem.

3. Concerns about fishery products

- New rules must be fair, practical, and based on science.
- Need acceptance from fishers to make measures effective.
- Risk: losing trust if laws are seen as unrealistic and unfair.

4. Everyday life of an administrator / politician

- Draft laws and evaluate research data.
- Discuss with fishers, scientists, NGOs to find fair solutions.
- Monitor compliance and economic impacts.

5. Possible solutions

- Support technological innovations (e.g. selective nets and pingers).
- Establish protected areas for endangered species.
- Establish regular inspections for sustainable fishing.
- Cooperation with science and fishers.
- Funding programs and incentives for sustainable practices.

6. Future of fishing

- Goal: healthy seas and stable fish stocks for future generations.
- Need long-term, fair, and science-based solutions.
- Collaboration with all stakeholders is essential.

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